IMPERIAL MYCOLOGICAL
30 OCT 1934
INSTITUTE

TRINIDAD AND TOBAGO.

ADMINISTRATION REPORT

OF THE

DIRECTOR OF AGRICULTURE

FOR THE YEAR 1933.

TRINIDAD:

PRINTED BY THE GOVERNMENT PRINTER,
GOVERNMENT PRINTING OFFICE,
PORT-OF-SPAIN.

1934.

TRINIDAD AND TOBAGO.

Council Paper No. 84 of 1934.

DEPARTMENT OF AGRICULTURE.

Administration Report of the Director of Agriculture for the year 1933.

Circulated for information. To be laid before the Legislative Council.

Previous Council Paper No. 33 of 1933.

Registered No. of Correspondence relating to the subject—M.P. No. 21884.

TRINIDAD:
PRINTED BY THE GOVERNMENT PRINTER,
GOVERNMENT PRINTING OFFICE,
PORT-OF-SPAIN.

1934.

[*Price* 1/9.]

REPORT OF THE DEPARTMENT OF AGRICULTURE FOR THE YEAR 1933.

CONTENTS.

	Page.
PART I.—ADMINISTRATION REPORT OF THE DIRECTOR OF AGRICULTURE—	
Agricultural Export Industries	4
Departmental Institutions and Other Activities	8
Revenue and Expenditure	14
Staff	14
PART II.—DIVISIONAL REPORTS—	
Report of Agronomist	17
Government Stock Farm, Trinidad	26
Report of Veterinary Division	29
St. Augustine Nursery	31
St. Augustine Experiment Station	34
Report of Curator, Botanic Gardens....	35
River Estate	36
Report of Mycologist	43
Witchbroom Investigations	45
Wilt Disease of Coconuts	46
Report of the Chief Inspector, Plant Protection Ordinance	48
PART III.—ANNEXURES—	
Revenue and Expenditure, 1933	53
Agricultural Exports, Trinidad and Tobago	54
Annual Rainfall, Port-of-Spain, Trinidad	55

DEPARTMENT OF AGRICULTURE.

Administration Report of the Director of Agriculture for the year 1933.

Council Paper No. 84 of 1934. *M.P. No. 21884.*

I.—AGRICULTURAL EXPORT INDUSTRIES.

In 1933 the value of the agricultural exports amounted to £1,896,644 as compared with £1,667,594 in the previous year. The excess of approximately £230,000 is to the good, but the effect on the agricultural community of Trinidad and Tobago of the continued low prices for primary products will be realized when it is recalled that the average yearly value of the agricultural exports of the colony for the years 1926, 1927, and 1928 amounted to no less than £2,902,645. The values of the staple and minor agricultural exports for 1931, 1932, and 1933 are given below, together with comparative figures showing the average yearly value for 1926-28.

Agricultural Exports.

Article.	1926-1928 average yearly value.	1931 value.	1932 value.	1933 value.
	£	£	£	£
Cacao	1,531,148	826,333	579,170	555,907
Sugar and Bye-products	1,014,677	934,633	888,092	1,160,054
Coconuts and Coconut Products ..	223,768	115,515	106,786	108,009
Coffee	12,833	16,276	21,124	7,416
Limes and Lime Products	6,056	34,921	18,086	27,210
Grapefruit and Oranges	2,028	4,587	13,606	5,618
Grapefruit and Orange Juices ..	..	..	..	1,759
Tonca Beans	1,824	3,583	12,993	3,004
Pulse, Beans and Peas	4,816	2,783	1,993	2,515
Livestock and Hides	8,441	6,221	3,015	1,490
Bitters	76,862	27,288	18,962	21,205
Miscellaneous	20,192	3,485	3,767	2,457
	2,902,645	1,975,625	1,667,594	1,896,644

2. For the second year in succession sugar and its bye-products have held the premier place among the agricultural exports of the colony and have far out-distanced cocoa which for many years was a successful rival.

3. Compared with 1932, coconuts and bye-products show a slight increase; coffee and tonca beans a definite falling off; limes and lime products an appreciable increase; and grapefruit and oranges a relatively large reduction in values.

4. There has been but little change in the acreages under the major crops, with the exception of a limited turn over from cocoa to sugar in certain areas. Plantings of grapefruit, oranges, tonca beans, robusta coffee have been continued, but not on a sufficiently large scale to affect fundamentally the agricultural activities of the colony.

COCOA.

5. During the eight years 1926-1933 the quantities of cocoa exported and the prices per fanega (110 lbs.) were as follows:—

	Exports. *lb.*	*Value.* £	*Price per fanega* (110 *lb.*) $ c.
1926	50,067,881	1,270,335	12.99
1927	51,934,857	1,671,883	15.82
1928	58,008,156	1,651,179	13.21
1929	61,888,740	1,446,127	10.99
1930	53,825,120	1,136,056	9.34
1931	57,186,512	826,333	6.88
1932	41,822,127	579,170	6.94
1933	51,311,274	555,907	5.03

6. Weather conditions were more favourable than in 1932 and the exports for the calendar year 1933 amounted to over 51,000,000 lbs. as compared with somewhat under 42,000,000 lbs. in 1932. The average price for the year fell to the abnormally low figure of $5.03 per fanega, according to returns kindly supplied by the Cocoa Planters' Association, and the gross value of the far larger crop of 1933 was less than that of the 1932 exports.

7. The table above shows that in the years 1926, 1927, and 1933 the exports happened to be approximately equal, but the values were £1,270,335, £1,671,883, and £555,907, respectively. Broadly, the total acreages under cocoa in these years were more or less the same, and such a drastic cut in the income of the cocoa grower has naturally been the cause of the gravest financial embarrassment to those engaged in the cultivation of this crop.

Witchbroom Incidence.

8. During the year the witchbroom disease of cocoa continued to spread to new areas and a rapid increase was noticeable in the number of trees affected on individual estates. This subject is dealt with in more detail later in my report and in the appended report of the Mycologist.

Thrips.

9. Thrips again proved a very serious pest and were responsible in certain sections for much loss in the cocoa crop.

SUGAR.

Sugar Production.

10. During both the growing season and the harvesting period weather conditions were favourable for the sugar industry, and the Factories produced 120,763 tons, which established a record for the colony. Production figures for the past eight years are given below :—

	Tons.
1926	73,561
1927	51,982
1928	81,551
1929	89,926
1930	79,848
1931	98,573
1932	97,598
1933	120,763

Exports and Values of Sugar and Sugar Bye-products.

11. According to the Customs Returns the following quantities and values of sugar, molasses, and rum were exported from 1926 to 1933.

	Sugar.		Molasses.		Rum.		Prices Grey Crystals f.o.b. per ton.
	Exports.	Value.	Exports.	Value.	Exports.	Value.	
	Tons.	£	Gals.	£	Gals.	£	£ s. d.
1926	65,680	1,003,230	1,427,274	14,330	71,213	10,933	14 15 0
1927	41,805	762,366	1,188,840	14,471	35,699	8,155	16 10 0
1928	74,112	1,201,477	1,622,018	16,913	55,088	12,157	14 10 0
1929	81,503	1,049,863	1,373,420	18,227	73,841	13,639	11 10 0
1930	69,138	776,167	899,051	11,238	72,063	14,313	10 5 0
1931	86,054	902,990	1,599,414	15,924	86,260	15,719	9 0 0
1932	85,956	845,974	2,701,921	14,697	139,540	27,521	9 14 2
1933	108,516	1,115,567	3,026,077	31,634	63,907	12,853	9 10 0

The Cane Farming Industry.

12. In 1933 cane farmers sold 488,174 tons of canes to the factories for which they received £297,822 ; in 1932 the tonnage sold was 455,213 and the value £276,857. The sugar manufacturers again voluntarily maintained a basic price of 12/- per ton and the farmers consequently received £120,000 more than the value of their canes according to the official sliding scale.

13. As is not unnatural in the circumstances, there is a very keen desire on the part of cane farmers to extend their acreages on an appreciable scale but various considerations have made such a course impracticable at the present time.

COCONUTS.

Exports and Values.

14. In spite of a definite increase in the quantity of copra exported in 1933 as compared with the previous year, the value was actually less owing to the low prices prevailing during the year. Exports and values are given below for the exports of coconuts, copra, and coconut oil for the years 1926-1933.

	Coconuts.		Copra.		Coconut Oil.		Price of Copra.
	Exports.	Value.	Exports.	Value.	Exports.	Value.	
	Nuts.	£	lb.	£	Gals.	£	100 lb.
1926	5,041,036	25,135	13,858,996	166,263	82,791	15,373	23s.
1927	6,463,765	32,298	12,498,983	146,895	58,061	11,102	22s.
1928	6,799,655	34,824	21,351,860	227,555	65,285	11,860	20s.
1929	13,608,118	66,320	23,979,882	209,732	34,707	5,403	17s.
1930	5,886,127	25,830	21,891,259	175,965	41,154	5,938	14s.
1931	4,487,875	12,549	19,484,808	101,148	20,702	1,818	8s. 9d.
1932	3,847,245	12,822	15,418,906	91,444	26,461	2,520	10s. 2½d.
1933	7,888,980	21,406	19,357,980	82,945	45,565	3,658	9s. 5¼d.

Coconut Oil Factories.

15. As a result of the agreement entered into by Government with the local Oil Factories, the sum of £15,133 was distributed to copra producers in the form of a bonus on the purchase of 8,961,001 lbs. of copra.

Coconut Wilt.

16. As in the case of 1932, the rainfall for the usual dry season was unusually high, and wilt was not very much in evidence except on certain estates. This must, however, be regarded as a temporary check and does not minimize the losses that are certain to occur in areas other than those ideally suited for the growth of coconuts.

Hurricane Damage.

17. Unfortunately one of the most important coconut sections was seriously damaged by the hurricane in June.

LIMES AND LIME PRODUCTS.

Exports of Lime Products.

18. *Essential Oil.*—The lime industry of the colony has again been carried by the sales of essential oil, the exports of which were double that of the previous year and were valued at £22,575. Exports and values for the years 1926-1933 were as follows:—

	Exports. Gals.	*Value.* £
1926	431	5,312
1927	104	1,454
1928	495	5,894
1929	797	9,516
1930	1,647	19,457
1931	2,413	32,071
1932	929	12,840
1933	1,889	22,575

19. *Lime Juice.*—There was a slight increase in the exports of concentrated juice and an appreciable falling off in the shipments of raw juices.

	Concentrated Juice.		Raw Juice.	
	Exports.	Value.	Exports.	Value.
	Gals.	£	Gals.	£
1926	7,886	1,926	Nil.	Nil.
1927	4,488	1,154	Nil.	Nil.
1928	5,653	1,487	Nil.	Nil.
1929	55,455	11,562	Nil.	Nil.
1930	21,762	3,759	47,554	4,096
1931	4,012	458	22,931	2,007
1932	8,583	427	46,629	4,250
1933	11,709	622	17,375	1,203

20. *Citrate of Lime.*—Only 52,800 lbs. of citrate of lime, valued at £389, were exported.

21. *Green Limes.*—Various efforts have been made to popularize green limes in northern markets as a substitute for lemons. For the second year intensive advertising was undertaken by the Permanent Exhibition Committee at the Canadian National Exhibition and large quantities of limes distributed, but, for one reason or another, the commercial shipments to Canada met an unfavourable market. Investigations were made, with the assistance of the West India Committee, as to the possibilities of finding a market in the United Kingdom, and the hybrid lime T.1 is being tested as this variety fruits throughout the year.

Future Prospects.

22. At the Fruit and Vegetable Conference that was held in Jamaica in October 1933, the future prospects of the lime industry of the West Indies were discussed. Much concern was felt at the rapid extension of the acreages planted to limes in the past few years. Unrestricted expansion, following on the loss of the outlet for concentrated lime juice for the manufacture of citric acid, points to overproduction, glutted markets, and low prices. For this reason the Conference considered it desirable that a warning should be issued and that whatever steps were practicable should be taken to curtail further plantings. The Departments of Agriculture in Trinidad and the Northern Islands have consequently decided to reduce the quantities of lime plants grown for distribution.

GRAPEFRUIT.

Exports.

23. The year proved disappointing to growers of grapefruit. Owing to heavy rains during the flowering period, there was a very short crop and the exports fell from approximately 11,000 cases to 3,433. New plantings continue to be made and the area under budded varieties is estimated to be 1,400 acres. Market reports and sale returns continue to bear testimony to the excellent qualities of Trinidad grapefruit.

	Exports. Boxes.
1926	54
1927	1,649
1928	23
1929	807
1930	2,184
1931	4,377
1932	10,973
1933	3,433

COFFEE.

24. In 1933 there was an appreciable fall in the exports of coffee, owing largely to a short crop. Exports and values for the years 1926-1933 are given below :—

	Exports. lb.	*Value.* £
1926	497,688	20,371
1927	164,072	7,246
1928	265,410	10,883
1929	817,983	32,309
1930	491,988	12,525
1931	857,920	16,276
1932	908,492	20,822
1933	339,196	7,416

TONCA BEANS.

25. Wide yearly fluctuations in yield are a feature of tonca beans and 1933 was an off year for this crop.

	Exports. lb.	*Value.* £
1926	83	8
1927	10,015	1,669
1928	884	147
1929	15,266	2,544
1930	9,219	1,538
1931	22,950	3,583
1932	69,276	12,993
1933	9,979	3,004

II.—DEPARTMENTAL INSTITUTIONS AND OTHER ACTIVITIES.

26. The notes that follow relate briefly to the work of the departmental institutions and to other matters of agricultural interest. Divisional reports, prepared by the officers in charge, are appended and should be consulted for more detailed information.

COCOA.

River Estate.

27. In his report the Manager, Mr. R. O'Connor gives an account of the working of River Estate and of the agricultural and timber developments; the Agronomist, Mr. J. de Verteuil, deals with the experimental work.

28. The cocoa crops for the past five calendar years have been :

1929	1,411 bags.
1930	1,083 do.
1931	1,008 do.
1932	1,325 do.
1933	1,164 do.

29. A very marked improvement is noticeable in the citrus block which is on soil of poor fertility. Limes, tonca beans, and robusta coffee are proving useful subsidiary crops. Mr. O'Connor's work in connection with the development of the timber plantations, which cover approximately 500 acres, has been carried out with little money and is deserving of special comment.

Experimental Work.

30. *Distance Planting.*—These plots have been bearing for the past sixteen years and during this period the crops for the plots planted 12 and 14 feet apart are practically identical, viz., 443 and 440 pounds of commercial cocoa per acre per annum, respectively. These yields are appreciably higher than those recorded for the plots planted at 16 and 18 feet. During later years the wider plantings have made considerable progress, as will be seen below :—

AVERAGE YIELD FOR PERIODS OF 5 YEARS, FROM 1919 TO 1933.

	Lb. Commercial Cocoa per Acre per Annum.			
	12 x 12 ft.	14 x 14 ft.	16 x 16 ft.	18 x 18 ft.
5 years average (1919-23) ..	302	220	135	123
5 years average (1924-28) ..	464	531	451	397
5 years average (1929-33) ..	639	653	647	626

31. For the first five-year period, the advantage is undoubtedly in favour of the plot planted at 12 feet. During the following two periods, the plot planted 14 feet apart gave the highest yield, but there is very little difference in the yield of the plots for the last period (1929-33). Calculated in pounds commercial cocoa per acre, the total crops are as follows :—

12 *ft. apart.*	14 *ft apart..*	16 *ft. apart.*	18 *ft. apart.*
7,095	7,042	6,179	5,753

32. The yields for the plots planted at 14, 16, and 18 feet apart are still on the increase, whereas the plot planted ar 12 feet appears to have reached its maximum production.

33. *Budded Plants vs. Seedlings.*—The average crops for the past sixteen years (1918-33), in this experiment, which was started in 1914, do not show any marked difference between Budded plants and Seedlings. During the past two years, however, the Budded plots have given better results than the Seedlings.

34. *Colour of Pods.*—The yields for 1933 in the Colour of Pods experiment, worked out in pounds of commercial cocoa per acre, are as follows :—

Seedlings from yellow pods	734
Seedlings from red pods	875
Single bud from yellow pods	874
Single bud from red pods	1,481

	Yellow.	*Red.*
Two buds on same stock, one yellow and one red ..	308	802
Two buds on separate stock, one yellow and one red	334	433
Two seedlings at same stake, one yellow and one red	145	549

35. There is a distinct advantage, in this experiment, in favour of the plots grown from trees bearing red pods.

36. *Fertiliser and Manurial Experiments.*—The yields for the fertiliser experiments started eight years ago were grouped so as to compare the results of the first period of five years with the subsequent three years. The results for the latter are much better than for the first five years due to the fact that the treated plots have maintained their yields, whereas the crops for the control plot were appreciably lower. The best results were obtained on the plots treated with Nitrogen plus Phosphate and with a complete fertiliser.

37. The experiment designed to ascertain the best time for applying a complete fertiliser to cacao trees shows a distinct advantage, for the third time, in favour of early application, *i.e.* in January.

The Cacao Research Scheme.

38. The Department has gladly placed at the disposal of the officers of the Cacao Research Scheme the special facilities available at River Estate. Use has been made by these officers of the data collected in the past relating to the yields of individual trees ; critical examination of high yielding trees has been made by Mr. Pound ; and fertiliser experiments have been laid down by Professor Hardy.

Witchbroom Disease of Cocoa.

Inspection Service.

39. The regular Witchbroom inspection service was maintained during the year and over 26,000 visits were paid by the Assistant Witchbroom Inspectors to cocoa properties. With the low prices for cocoa, it has been quite impracticable to insist on adequate control measures, and the powers given to the Department under the Plant Protection Ordinance have been exercised only in cases of flagrant neglect ; 277 orders were issued and 16 proprietors were prosecuted.

Spread of Disease.

40. Each year Witchbroom disease gets a firmer grip on the cocoa industry of the colony ; at the end of 1933 the disease had been found on 4,445 properties as compared with 3,887 to the end of 1932, and areas that two or three years ago were but moderately infected are now heavily infected. Rapidity of spread and intensity of infection are undoubtedly governed by varying conditions of rainfall and humidity, but it is clear that a progressive and accumulative development of the disease is taking place that will eventually embrace every cocoa growing section in the colony.

Marper Witchbroom Estate.

41. Marper estate was purchased by Government in 1928 and was at the time heavily infested with Witchbroom, especially in the lower lying sections. The only practicable control measure known, namely, the systematic cutting off and destruction of brooms before mushrooms are formed, has been carried out from year to year. In 1933 the cost of this work was $6.20 per acre, but this expenditure included charges, due to the experimental nature of the work and amounting to $1.10 that would not have been necessary in ordinary estate practice. The count of brooms and mushrooms, as well as the crops for the past three years, are given below :—

	1931.	1932.	1933.
Brooms	250,538	195,595	223,328
Mushrooms	2,637	665	68
Crops—bags	196	211	202

42. Various sprays and manurial treatments have been tested but with negative results as far as their effect on Witchbroom is concerned. Incidentally, the benefit of Bordeaux mixture has been very striking in a block that was affected by thrips, as a result of excessive shade reduction in one of the Witchbroom experiments.

Strains of Cocoa Resistant to Witchbroom.

43. During the year the Mycologist, Mr. F. Stell, spent six weeks in Ecuador and in his report on his visit (Council Paper No. 137) he gives an account of the successful efforts that are now being made by several planters in that country to develop strains of cocoa resistant to Witchbroom. This success opens a new field of endeavour for combating Witchbroom. Unfortunately Mr. Stell fell ill in Ecuador and had to leave hurriedly for medical treatment at Panama. As a result Mr. Stell was unable to collect and bring with him planting material that he had selected, and negotiations are being conducted with the Government of Ecuador and the planters with a view to obtaining the plants and budwood of resistant strains promised to him during his visit.

SUGAR.

Sugar Cane Investigation Committee.

44. Government and the Sugar Manufacturers each contributed £2,126 to the work of the Sugar Cane Investigation Committee, and a generous grant was received from the Empire Marketing Board for the first nine months of the year and from the Colonial Development Fund for the months October to December.

45. The results of the investigations of the Scientific Staff, bearing on soils, fertilisers, and the bionomics of the froghopper, are reported in the monthly Proceedings of the Committee.

Varietal Trials.

46. The second report of the Assistant Director of Agriculture on the estate varietal trials initiated by the Department in 1929 has been issued in the form of a bulletin. The results are of considerable interest and perhaps the most important fact brought to light is the excellent cropping power of Co.213 under certain soil and rainfall conditions.

Survey of the Cane Farming Industry.

47. A comprehensive and detailed survey of the cane farming industry was undertaken by the Assistant Director of Agriculture with funds contributed by the Empire Marketing Board. The work was started in September, 1932, and was brought to a close towards the end of 1933. A preliminary report was published in July (Council Paper No. 84) and the final report was submitted to Government in November. (Council Paper No. 135.)

48. The statistical evidence collected bears on all important phases of the industry and is of much interest and value.

49. The industry was examined as a whole, and, in addition, an intensive study was made of cultural operations, costings, and receipts on individual farms in selected areas. The report will be of much value in relation to questions of policy connected with the cane farming industry.

COCONUT WILT INVESTIGATIONS.

50. In Part II is the report of Mr. F. M. Bain, Agricultural Officer, on his investigations of Coconut Wilt. While it is not yet possible to point to the exact cause, or causes, of this serious trouble, promising lines for further study have been determined as the outcome of the experimental work to date.

ST. AUGUSTINE NURSERIES AND EXPERIMENTAL STATION.

51. The nurseries were maintained in good order and economic plants to the number of 92,719 were distributed during the year, including 23,049 budded grapefruit as compared with 13,000 odd in 1932; citrus buds to the number of 26,418 were also distributed. The revenue from the sale of plants amounted to £1,374 17s. 0½d.

52. The citrus experimental block of 45 acres, which was planted to grapefruit and oranges in 1932, has made a very satisfactory start, and, in the comparatively short time since the experiments were initiated, the young trees have demonstrated the need for fertilisers under the soil conditions at the Station.

53. Lime growers have been much interested in the T.1 lime, which has two advantages over the West Indian lime, namely, its resistance to withertip and its habit of fruiting more or less throughout the year. T.1 limes are available for shipment when green limes are in greatest demand on the New York market, but when the West Indian lime is not yet ready for marketing. Investigations of the value of the oil prepared from the T.1 lime are being continued.

54. The acreage under sugar cane has been definitely curtailed as the soil at the Station is not typical of the cane growing areas, but a section has been reserved for the multiplication, in the early stages, of new varieties imported from Barbados and elsewhere and passed through the Plant Quarantine Station. The collection of various varieties of sugar cane is being maintained.

BANANA EXPERIMENTAL SHIPMENTS.

55. The disappointing financial results of the experimental banana shipments in 1932 made it necessary to either abandon the shipments or to find a more rapid means of transport than was at the time available. Negotiations were consequently entered into with Messrs. Elders & Fyffes, and Mr. Hal Stockley, Manager Director, kindly consented to provide space for 2,000 bunches. The trial shipments by the Elders & Fyffes steamers proved successful and in each case netted a handsome profit.

56. Since the close of the year a five year contract has been signed with the Canadian Banana Company at fixed prices.

57. Banana culture for export purposes on the scale now contemplated is a new venture for the colony, and it is important that the industry should be organized on sound lines and that the possibilities and limitations should be clearly understood.

58. Conditions in Trinidad are not in general ideal for banana cultivation. Much of the soil is of too heavy a character and the reaction is acid rather than neutral or alkaline. Panama disease is already scattered throughout the colony and planters must realize that the progress of the new industry will be hampered step by step by this disease.

59. On the other hand, if the danger of Panama disease be fully recognized and such precautions as are possible be taken, banana growing for export should prove a most valuable aid at the present juncture. The planting of large blocks of pure stands of bananas should be avoided and, at least until more local experience is gained, development should be confined to—

(1) The rapid multiplication of the existing banana population, of which there is already a fair nucleus interplanted with cocoa.

(2) The planting of small blocks of bananas, say, from 5 to 10 acres, preferably on soils that are neutral or alkaline in reaction.

60. On established cocoa estates bananas can be planted among cocoa with but little extra cost ; no capital investment is needed for the purchase of land or for clearing forest growth, and supervision charges will be negligible. Now that there is an assured market for bananas for five years at known prices, both large and small proprietors should make the fullest use possible of this opportunity of planting bananas as a supplementary crop, provided, of course, that soil and rainfall conditions are reasonably suitable.

61. Much credit is due to the Supervising Witchbroom Inspector, his Assistant, and the Inspectors, as well as to the Agricultural Advisers for St. Georges, Caroni, and the Eastern Counties, for the interest taken in the trial shipments and for the energy displayed in collecting fruit from widely scattered sources.

GOVERNMENT STOCK FARM AND VETERINARY WORK.

Government Stock Farm.

62. An account of the work at the Government Stock Farm, Trinidad, will be found in the report of the Officer in Charge, Captain H. V. M. Metivier.

63. The cattle breeding programme designed to establish a Zebu-Friesian cross with special qualifications for tropical conditions was continued, and useful data is gradually being acquired regarding the characteristics of half-bred, three-quarter bred, and seven-eights bred animals.

64. At the Annual Sale cattle, pigs, sheep, and poultry of good breeding were put up for sale by auction. A sum of £605 13s. 9d. was realized. Sales of livestock at other times during the year brought in a revenue of £571 14s. 11½d.

65. Public institutions were supplied with 31,408 gallons of milk or 3,200 gallons more than in 1932.

The operating expenses detailed at the end of Captain Metivier's report show a profit on the year's working of approximately £1,000.

66. The Government Farm continues to be a source of attraction and education to visitors, and continues to play an important part in fostering the development of the livestock industry of the colony.

Paralytic Rabies.

67. The Committee appointed towards the end of 1932 reported to Government early in 1933, and, as a result of the Committee's recommendations, additional facilities were provided for the production of anti-rabies vaccine. The disease was proclaimed in certain areas and an intensive campaign of inoculation was undertaken by the Government Veterinary Surgeon, with the assistance of the Veterinary Surgeon from Tobago, who was transferred to Trinidad, and the Assistant Officer in Charge of the Government Farm. During the year, 15,707 animals were inoculated as compared with 6,000 in the previous year.

68. There was a reduction in the number of deaths reported, which amounted to 308 as compared with 500 in 1932.

69. As in the previous years, the disease was more or less confined to certain districts, although odd cases occurred beyond the limit of these areas.

70. Experimental proof was obtained by the Government Veterinary Surgeon and the Government Bacteriologist of the infectious nature of the saliva of affected animals, but such evidence as is available justifies the view that the bites of bats are primarily, if not entirely, responsible for the occurrence of this disease in livestock.

DISTRICT AGRICULTURAL WORK.

71. In addition to their routine district duties, the Agricultural Advisers paid visits of inspection to properties mortgaged to the Agricultural Bank, and undertook the preliminary judging of 144 school gardens. The Agricultural Advisers in St. Patrick and Victoria devoted much time to examination of the properties damaged by the hurricane that struck the south of the island in June, 1933.

72. In Tobago the Agricultural Adviser was placed in charge of the Stock Farm when the Veterinary Surgeon was transferred to Trinidad. As usual his time has been largely devoted to guiding the work of the Agricultural Credit Societies and the Co-operative Fermentaries. He has also been associated with the efforts to establish a widespread co-operative organization.

73. As a result of the interest in banana cultivation, a new bias has been given to the work of the Agricultural Advisers, who now have the important and new duty of endeavouring to ensure that the young banana industry is developed on sound lines.

74. The work of the Assistant Witchbroom Inspectors was extended to include the collection and purchasing of bananas and the control of Panama disease. These Inspectors cover large areas and pay regular visits to many properties well adapted for bananas, and certain phases of banana work can conveniently and advantageously be dovetailed with their normal duties.

75. With a view to improving the quality of peasants' cocoa, the Legislative Council approved of the erection of two Government fermentaries. The first was built towards the end of the year at Biche and promises to be of much benefit to the district.

76. The Agricultural Advisers kept well in mind the importance of encouraging the growth of food crops for local consumption, but the colony's annual bill for imported foods remains disappointingly high. Flour imports alone were valued at £282,640 or approximately the same value as in 1932; there was a marked reduction in the value of condensed milk which dropped from £103,000 to £83,000; rice imports were valued at £158,000 or £10,000 less than in 1932; and "vegetables" were valued at £55,256, showing a saving of approximately £5,000. Praedial larceny, the ease with which the local market is glutted, and the small areas suitable for rice cultivation, are all given as reasons for the reluctance shown by agriculturists to extend the acreages under food crops.

AGRICULTURAL CO-OPERATIVE SOCIETIES.

Agricultural Credit Societies.

77. *Tobago.*—The thirteen Agricultural Credit Societies in Tobago continued to function, and at the close of the year had a membership of 534. During the year new loans granted amounted to £1,045; the sum of £943 was repaid as capital and interest on old and new loans, and at the end of 1933 the indebtedness of the Societies amounted to £2,901, of which the sum of £1,554 was overdue. The continued depression in the market value of cocoa and other agricultural produce is responsible for the fact that a number of the Societies have not been able to meet their obligations satisfactorily.

78. *Trinidad.*—Three new credit societies were registered during the year making a total of thirty-six societies operating in Trinidad of which twenty-two have the advantage of being under the management of the Ste. Madeleine Company.

79. The other fourteen are under the control of the Department and are closely supervised by Mr. C. K. Hutchinson, Agricultural Adviser. The system by which advances to members are repayable within a year has worked satisfactorily and five of the six societies, to which loans were granted on these terms, paid their liabilities in full. The balance outstanding by three societies—two old and one new—was £348, whilst new loans granted to the other eleven societies during the year amounted to £1,348 making a total of £1,696. The membership at the end of December for the fourteen societies was 388.

Tobago Producers' Association.

80. A wide and comprehensive scheme of agricultural co-operation is being developed in Tobago with a view to enabling large and small proprietors to make the best use possible of the varied resources of the island. The Association is fortunate in having, as the Chairman of the Committee of Management, Major H. W. Peebles, C.M.G., D.S.O., who has now settled in Tobago after retiring from the post of Administrator of St. Vincent.

Tobago Lime Growers' Co-operative Association.

81. This Association again had a successful year and handled 2,821 barrels of limes for which members received $2.00 per barrel. Before the establishment of the Lime Factory it was not found profitable to pick the lime crop.

Co-operative Cocoa Fermentaries in Tobago.

82. Both the Pembroke and Roxborough fermentaries have done well during the year, the cocoa handled being 553 and 426 fanegas, respectively. Adequate building and curing facilities have now been provided as a result of the financial assistance given by Government. Two more fermentaries are in process of formation.

Co-operative Citrus Growers' Association of Trinidad and Tobago.

83. Owing to the abnormal weather conditions which prevailed during the 1932-33 season there was a shortage in the citrus crop. As a result the Association handled 6,525 cases of grapefruit and 907 cases of oranges, as against 10,700 cases of grapefruit and 1,566 cases of oranges during the preceding season. Satisfactory prices were, however, obtained, and the facilities afforded by the modern equipment of the Packing House have in a large measure been responsible for the high reputation established by Trinidad grapefruit on the English market.

HORTICULTURAL EXHIBITION.

84. Much assistance was given by the Department of Agriculture at the Exhibition held by the Horticultural Club of which Mr. R. O. Williams, Economic Botanist, is President. The special display staged by Mr. H. Bruins-Lich, Curator, was a striking feature of the Exhibition.

COMMITTEE WORK.

85. The Director of Agriculture, the Assistant Director, and the Economic Botanist were involved, as usual, in a large amount of committee work during the year. The committees on which one or another of these officers served as Chairman or as member, include the Agricultural Bank, the Cocoa Relief Committee, the Hurricane Relief Committee, the Sugar Cane Investigation Committee, the Citrus Growers' Co-operative Association, Plant Quarantine Committee, and the Ground Provisions Depot Committee.

HURRICANE DAMAGE.

86. One of the agricultural advantages of Trinidad has been its freedom from hurricanes, but unfortunately in June the south of the island was struck by a hurricane and much damage was done to coconut and cocoa plantations. A careful estimate revealed that the following acreages were affected :—

	Extent of Damage.			
	Heavy.	*Medium.*	*Light.*	*Total.*
Coconuts	3,909	1,038	2,694	7,641
Cocoa	12,426	5,371	4,249	22,046

87. The Icacos district was the finest coconut section in the island and the damage in that area was particularly regrettable. A loan of $2.50 per acre, that was afterwards converted into a gift, was made by Government for the purpose of clearing the hurricane debris. Government assistance for the re-establishment of the cultivations has since been sanctioned by the Legislature and a sum of £150,000 was voted for the purpose of granting loans over a period of five years.

WEST INDIAN FRUIT AND VEGETABLE CONFERENCE.

88. In October, I attended the Fruit and Vegetable Conference in Jamaica, which had been convened by the Secretary of State for the purpose of determining the soundest policy for the further development of the fruit and vegetable export industries of the British Colonies in the Caribbean area.

89. The report of the Conference contains a number of valuable recommendations for the guidance of the colonies concerned. Stress is laid on the importance (1) of co-operative effort among the growers in each of the units represented at the Conference and (2) of general co-ordination between the colonies as a whole. To secure the latter object, it was recommended that two West Indian Fruit and Vegetable Councils should be established—one for the Eastern Group and one for the Western.

90. Among other matters discussed were : the potentialities of the grapefruit and orange industries ; the need for caution in the further planting of limes ; tomato growing and the consuming capacity of the Canadian market at different periods ; the need for further investigations to test the export possibilities of mangoes, avocado pears, and pineapples on a larger scale than has been found possible in the past. Such general subjects as legislation, standardisation of exports, advertising, and shipping facilities were also fully considered.

IMPERIAL COLLEGE OF TROPICAL AGRICULTURE.

91. I have to record again my gratitude to the Principal and members of the staff of the Imperial College of Tropical Agriculture for their close co-operation with officers of the Department in many matters bearing on the development of the agricultural industries of the colony.

III.—REVENUE AND EXPENDITURE.

92. In Annexure " A " is a detailed statement of the accounts of the Department for the year 1933. The total expenditure amounted to £47,982 and the revenue to £16,590. On the revenue side, the Stock Farm in Trinidad brought in £6,994, River Estate £2,544, the St. Augustine Nurseries and Experimental Station £1,374 and Veterinary fees £1,498.

93. Apart from the expenditure that can be considered normal in a department of agriculture, work under the Plant Protection Ordinance—especially in connection with the witchbroom inspection service—was responsible for the comparatively large sum of £5,225 ; the upkeep of the Royal Botanic Gardens, the Queen's Park Savannah and other Government grounds cost £3,606 ; and £2,126 was a contribution to the work of the Sugar Cane Investigation Committee.

IV.—STAFF.

94. I was absent from the colony on vacation leave from April to September and during this period the Assistant Director, Mr. S. M. Gilbert, acted as Director. The Economic Botanist, Mr. R. O. Williams, was absent on leave from September to December.

95. Mr. E. J. Gregory was appointed Manager of the St. Augustine Experimental Station in October, 1933.

96. Mr. Gilbert left the colony in November on promotion to the post of Chief Research Officer of the Coffee Research Station in Tanganyika, and carried with him the good wishes of the staff of the Department.

97. In conclusion, I take pleasure in acknowledging the excellent work performed by the officers of the Department during the year.

E. J. WORTLEY,
Director of Agriculture.

18th June, 1934.

PART II.

DIVISIONAL REPORTS.

	Page.
Report of Agronomist	17
Government Stock Farm, Trinidad	26
Report of Veterinary Division	29
St. Augustine Nursery	31
St. Augustine Experiment Station	34
Report of Curator, Botanic Gardens	35
River Estate	36
Report of Mycologist	43
Witchbroom Investigations	45
Wilt Disease of Coconuts	46
Report of the Chief Inspector, Plant Protection Ordinance	48

REPORT OF AGRONOMIST FOR 1933.

The report may be conveniently divided into the following sub-heads :—

I. Cacao Experiments at River Estate.
II. Marper Estate.
III. Manurial Experiments on Private Estates.
IV. Experiments in connection with Coconut Wilt.
V. General.

I.—CACAO EXPERIMENTS AT RIVER ESTATE.

2. The experimental work at River Estate consists of :—

(*a*) Distance Spacing Experiments.
(*b*) Propagation Experiments.
(*c*) Seedlings from Heavy Bearing Tree No. 4927.
(*d*) Colour of Pods Experiments.
(*e*) Manurial Experiments.

3. All results are computed for the experimental year, *i.e.* from 1st September of one year to 31st August of the following year.

Distance Spacing Experiments.

4. These comprise two sections, in Field 18, (*a*) plots planted in 1914, and (*b*) plots planted in 1922.

5. *Experiments Started in* 1914.—Four plots of approximately one acre each were planted in October 1914, with seedlings one year old, at distances of 12, 14, 16 and 18 feet apart, respectively. The seedlings were raised in bamboo pots from mixed seed obtained from heavy bearing trees of the Forastero type producing beans of good size and quality. Immortel trees were planted for shade in the centre of the space between four cacao trees at distances of 24, 28, 32 and 36 feet apart, respectively.

6. *Results.*—Cropping started in 1918 and for the first six years the plot planted 12 feet apart, gave the highest yield per acre. From 1924 to 1931, with one exception, *i.e.*, 1929, the highest yield was obtained for the plot planted 14 feet apart. In 1932 and 1933 the plots planted at 16 and 18 feet apart, respectively, have given the highest yield. This shows that with increasing age the trees planted further apart are bearing more heavily. The average yields for 16 years (1918-33), *i.e.*, from the first year of bearing are given below.

Average Yield for 16 years (1918-33).

	12×12 ft.	14×14 ft.	16×16 ft.	18×18 ft.
	301 trees.	227 trees.	173 trees.	130 trees.
Lb. commercial cacao per acre per annum	443	440	386	360

From the above it will be seen that after 16 crops the average yields for the plots planted 12 and 14 feet apart are practically the same. During the past five years. the crops for the plots planted at 16 and 18 feet apart have been steadily gaining ground and the figures set out below are interesting.

	Lb. Commercial Cacao per Acre per Annum.			
	12×12 ft.	14×14 ft.	16×16 ft.	18×18 ft.
5 years average (1919-23) ..	302	220	135	123
Do. (1924-28) ..	464	531	451	397
Do. (1929-33) ..	639	653	647	626

These figures show that there is very little difference in the average yield of the plots for the last period of five years. The plots planted at 14, 16 and 18 feet apart tend to give a further increase in yield whereas the plot planted at 12 feet appears to have reached its maximum production under ordinary conditions of cultivation. The latter has now been converted into a manurial experiment, and superphosphate of lime in varying quantities has been applied to the sub-plots.

The total yields to date, in pounds commercial cacao per acre are as follows :—

12 *feet apart.*	14 *feet apart.*	16 *feet apart.*	18 *feet apart.*
7,095	7,042	6,179	5,753

7. *Experiments Started in* 1922.—Three plots of approximately one acre each were planted in July, 1922, with seedlings one year old at distances of 6, 8 and 10 feet apart, respectively, without Immortel shade. The seedlings were raised in a nursery and each plot contains :—

40 per cent. of trees raised from Tree No. 808 of Field 5
30 do. do. 1285 do.
15 do. do. 716 do.
15 do. do. 646 do.

These parent trees are a good type of Forestero and heavy bearers.

8. *Results.*—Cropping started in 1926. The plot planted 6 feet apart has given the highest yield to date, but it should be pointed out that the soil, on which the trees are planted 10 feet apart is of inferior quality. The average yields for eight years (1926-33), *i.e.*, from the first year of bearing are as follows :—

Average Yield for 8 years (1926-33).

	6×6 feet.	8×8 feet.	10×10 feet.
	1,210 trees.	680 trees.	436 trees.
Lb. commercial cacao per acre per annum	318	255	132

The above yield for the plot planted 6 feet apart is slightly better than the average yield obtained for the first eight crops, for the plot planted at 12 feet in the first experiment, viz., 318 against 311 lb. of commercial cacao per acre per annum.

Yield for 1933.

	6×6 feet.	8×8 feet.	10×10 feet.
Lb. commercial cacao per acre per annum.	477	417	275

All the plots have given an increase in yield on the previous year, and the yields of the plots planted at 6 and 8 feet apart compared favourably with the yields of the plots planted at 12 and 16 feet, respectively at the same age.

Propagation Experiments.

9. The object of the experiment is to test the comparative merits on an estate scale of seedlings, budded and grafted cacao trees. Six plots, of approximately one acre each, were planted in November-December, 1914. Full particulars of the experiments are to be found at page 30 of the Annual Report for 1931.

10. *Results.*—The average results for 16 years (1918-33), from the first year of bearing and for 1933 are as follows :—

	Lb. Commercial Cacao per acre. per annum.	
With Immortel Shade.	**1918-33.**	**1933.**
(*a*) Budded at Stake	407	794
(*b*) Budded in Nursery	367	664
(*c*) Seedlings at Stake	411	464
(*d*) Grafted	388	675
Without Immortel Shade.		
(*e*) Budded at Stake	349	615
(*f*) Seedlings at Stake	375	579

From the above it will be seen that the plots grown from seed planted at stake have given a better average yield for the 16 crops (1918-33) than the budded and grafted plots, in both sections, respectively. During thd past two years, however, the plots raised with budded and grafted plants have given better yields than the seedling plots.

Seedlings from Heavy Bearing Tree No. 4927.

11. The average yield of this parent tree for four years (1913-16) was 332 pods per annum. In 1917 a plot of 178 stakes was planted 12 feet apart with seed from this tree. The average yield of the progeny for ten years (1924-33) amounted to 602 lb. of cured cacao per acre. In 1933 they produced 748 lb. of cured cacao or four and a half bags per acre.

Colour of Pod Experiment.

12. The object of this experiment is to try and ascertain :—

(*a*) Whether cacao trees raised from parent trees bearing yellow pods are more, or less prolific than those raised from trees bearing light red or dark red pods. This experiment is being made with seedling and budded trees respectively.

(*b*) Whether a better yield per acre would be obtained by having two trees at the same stake, one raised from trees bearing yellow and the other dark red pods. This experiment is also being made with seedling and budded trees.

13. There are two plots of budded trees. On one plot, buds from trees bearing yellow and dark red pods are on separate stock, on the other, both buds are on the same stock. The plants required were raised in a nursery and planted out in July, 1921 in part of Field 25 when they were one year old. There are 50 cacao trees in each plot spaced 13 feet apart, without Immortel shade.

14. *Results.*—The average yield for ten years (1924-33), *i.e.*, from the first year of bearing and for 1933 are set out below :—

	Lb. Commercial Cacao per acre per annum.	
	1924-33.	**1933.**
(*a*) Seedlings from yellow pods	304	734
(*b*) Seedlings from light red pods	245	624
(*c*) Seedlings from dark red pods	298	875
(*d*) Single bud from yellow pods	253	874
(*e*) Single bud from light red pods	286	745
(*f*) Single bud from dark red pods	675	1,481

	Yellow.	*Red.*		
(*g*) Two buds on same stock, one yellow and one red	114	305	419	1,110
(*h*) Two buds on separate stock, one yellow and one red	117	179	296	767
(*i*) Two seedlings at same stake, one yellow and one red	56	184	240	694

From the results recor led above it will be seen that the budded plots have given better crops than the seedling plots, both for the ten-year period (1924-33) and for 1933. The budded plots for the dark red pods have given very high yields, viz. : four and nine bags of cacao per acre for the ten-year period and 1933 respectively. These results are very much better than those of any of the other plots, and a crop of nine bags per acre without fertilisers is undoubtedly a record for Trinidad.

It will also be seen that no advantage has been gained by planting two budded or two seedling trees at the same stake and here again the yield for the red is greater than that of the yellow pods.

Manurial Experiments.

15. The main object of the experiments is *to attempt to obtain increased yields of cacao at a profit.* The experiments fall into four categories.

(i) Experiments in co-operation with Messrs. Imperial Chemical Industries, Ltd.
(ii) Experiments in co-operation with the American Cyanamid Company.
(iii) Pen Manure Experiments.
(iv) Experiments with Superphosphate of Lime

16. *Experiments in co-operation with Messrs. Imperial Chemical Industries, Ltd.*—These comprise (*a*) The experiments started in 1925 at River Estate. (*b*) The experiments started in 1930 at River Estate.

17.—(*a*) *Experiments started in 1925 at River Estate.*—These were started in October, 1925, and are being made in Fields 5 and 20. Four applications of the fertilisers have been made, one in December, 1925 and the others in May, 1928, 1930 and 1932, respectively. The experiments are being made on plots from which all the Immortel shade trees were cut out in 1910.

18. *Results for Field* 5.—The treatment accorded to each plot and the average results obtained per acre per annum, for the first five years (1926-30) after manuring, and for the following three years (1931-33) compared with the five-year period (1921-25) previous to manuring have been calculated and the profits are set out below. Cacao has been valued at ten cents per pound being the approximate average price of plantation cacao for the past eight years. Similarly, the cost of manuring is the average price paid for the fertilisers and of their application for the same period.

	Profit per acre per annum.	
	Five years	*Three years*
Treatment per acre, 1925, 1928, 1930 and 1932.	**1926-30.**	**1931-33.**
250 lb. Sulphate of Ammonia	$ 5.27	$ 17.87
250 lb. Sulphate of Ammonia 150 lb. Rock Phosphate 100 lb. Sulphate of Potash	17.99	25.59
250 lb. Sulphate of Ammonia 100 lb. Sulphate of Potash	Loss	10.02
250 lb. Sulphate of Ammonia 150 lb. Rock Phosphate	5.15	28.05
576 lb. Sulphate of Ammonia	Loss	Loss
1,152 lb. Sulphate of Ammonia	Loss	2.05
1,728 lb. Sulphate of Ammonia	Loss	6.89

From the above it will be seen that a larger profit has been obtained for the last three years than for the first five-year period (1926-30) for each plot respectively. The larger profit for the three-year period (1931-33) over the previous five years is due more to the manured plots having maintained their yields than to an actual increase in crop. The manured plots have given practically the same yield as that recorded for the first five years after manuring, whereas the control or *no manure* plot shows a decrease of 40 per cent. for the same period.

19. *Experiments in Field* 20.—The Experiment in Field 20 is on a larger scale and consists of a single plot treated with a complete fertiliser. The fertiliser treatment consists of 250 lb. Sulphate of Ammonia, 150 lb. Rock Phosphate and 100 lb. Sulphate of Potash. Owing to a misunderstanding the control plot was trenched, in June-September, 1932, and pen manure at the rate of 47 tons per acre was added to the mulch material for filling the trenches. The experiment therefore, is now trenching with pen manure *versus* a complete fertiliser.

20. *Results.*—The average results for the three years, before the control plot was trenched, show a profit of $3.29 per acre per annum for the complete fertiliser plot. The result for the first year after trenching shows that the trenched plot has given a profit of $1.40 per acre compared with the complete fertiliser plot.

21. *Experiments started in* 1930 *at River Estate.*—The object of the experiment is to *obtain information as to the best time of applying a complete fertiliser to cacao trees.* These trials are being made under full shade, partial shade and no shade conditions. Two applications of fertilisers, consisting of 250 lb. Sulphate of Ammonia, 150 lb. Rock Phosphate and 100 lb. Sulphate of Potash per acre, were made in 1930 and 1932, respectively, at the following periods .—(*a*) In January, (*b*) in May, (*c*) in September, and (*d*) in May and September, respectively, the latter being a double application.

22. *Results.*—Crop yields for three years (1931-33), after manuring have been obtained and the results show a distinct advantage for the early application (January) for each year. No pecuniary benefit has been derived for the double application of fertilisers, made in May and in September.

23. *Experiments in co-operation with the American Cyanamid Co.*—Trials with Ammo-phos (Grade 20/20) supplied by the above firm are being made in Fields 5 and 3A, at River Estate. Both fields are lightly shaded and the object is to test this fertiliser, both alone and in conjunction with Potash. The trials for Field 5 are on single plots. Three applications of the fertilisers have been made; the first in June, 1927 and the others in May, 1931 and 1933.

24. *Results for Field* 5.—The treatment accorded to each plot and the average results obtained per acre per annum, for the first five years (1928-32) after manuring and for the sixth year (1933) compared with the five-year period (1920-24) previous to manuring have been calculated and the profits are set out below.

	Profit per acre per annum.	
	Five years.	*Sixth year.*
Treatment per acre.	**1928-32.**	**1933.**
300 lb. Ammo-phos 100 lb. Sulphate of Potash	$ 4.80	Loss
400 lb. Ammo-phos	Loss	Loss
400 lb. Ammo-phos 100 lb. Sulphate of Potash	7.23	$ 5.67

25. *Experiment in Field* 3A.—There are four replicates of random plots, carrying 16 trees each. The manurial treatment consists of 300 lb. Ammo-phos (Grade 20/20) and 100 lb. Sulphate of Potash per acre. The fertilisers were applied in August, 1931 and July, 1933. Two crops have been reaped and although an increased yield has been obtained for the fertilised plot the results are not significant.

26. *" Pen Manure" Experiments.*—These were set out at the same time as the Ammo-phos plots, in Field 5, with the object of comparing the effects of applying pen manure in three different ways to cacao trees. Pen manure is valued at $1.20 per ton and it was applied at the rate of 15 tons per acre in June 1927, May, 1931 and 1933.

27. The average results for the first five-year period (1928-32) after manuring, show that there is little difference between burying the manure and applying it as a mulch, but both of these methods are preferable to burying the manure in semi-circular trenches around the trees. The results for the sixth year 1933 show a decided advantage in favour of the mulched plot.

28. *Experiments with Superphosphate of Lime.*—These are being made on the plot planted 12 feet apart, of the Distance Spacing Experiments, in Field 18. The second application of the fertiliser was made in May, 1933 and the yields for the first year have been recorded. They show that an increased crop has been obtained for the fertilised plots but the results are not significant.

Trenching Experiments.

29. The trenching experiments are being made in Fields 3A, 20 and 21.

30. *Experiment in Field* 3A.—The cacao trees are 60 to 65 years old, planted 15 feet apart and sparsely shaded with Immortel trees. Three plots aggregating 6.55 acres were trenched 2 feet wide by 18 inches deep, filled with all available material found on the spot and covered with earth from the trenches, from January to May, 1931, at a cost of $18.96 per acre. Two other plots comprising 2.9 acres were similarly trenched but 18 tons pen manure per acre were added, from June to August, 1931, at a cost of $31.29 per acre. The *natural yield* of each plot for one year is known and one crop subsequent to trenching has been obtained.

31. *Results.*—Each plot trenched without pen manure has given a slightly lower yield and each plot trenched with pen manure has given an appreciably higher yield than their respective yields previous to trenching. The average yields of the plots are as follows :—

Trenched without Pen Manure.		*Trenched with Pen Manure.*	
Lb. Commercial Cacao per acre.			
Natural yield.	*Yield after trenching.*	*Natural yield.*	*Yield after trenching.*
1932.	**1933.**	**1932.**	**1933.**
409	394	475	677

32. *Experiment in Field* 20.—The cacao trees are 30 to 35 years old, planted 12 feet apart and without Immortel shade. A block of 2.7 acres comprising four plots was trenched from June to September, 1932, and heavily pen manured, at the rate of 47 tons, costing $94.07 per acre. The *natural yield* of each plot for one year is known and one crop subsequent to trenching has been obtained.

33. *Results.*—The trenched plots have given an appreciable increase in yield on their respective yields previous to trenching. The average yield of the four plots is as follows :—

Lb. Commercial Cacao per acre.	
Natural yield, 1932.	*Yield after trenching*, 1933.
561	669

34. *Experiment in Field* 21.—The cacao trees are approximately 35 years old, planted 12 feet apart with ordinary Immortel shade conditions. A plot of 2.64 acres was trenched in March-April, 1932, and pen manure applied at the rate of 18 tons, costing $51.05 per acre. The *natural yield* of the plot for three years is known and one crop subsequent to the trenching has been obtained.

35. *Results.*—The trenched plot shows an appreciable increase on its average crop for the three previous years and the results are given below :

Lb. Commercial Cacao per acre.	
Natural yield, Three years' average (1930-32).	*Yield after trenching, First year* 1933.
523	682

36. *Mulch Experiments.*—The plots marked out in Field 25, for mulching trials, are to be treated with fertilisers and one half of each plot is to be mulched. The *natural yield* of each tree has been recorded for 1932 and 1933 and the treatments are to begin in 1934.

37. *Natural Yield of Plots in Field* 8.—Sixteen plots containing 16 trees each, forming a 4 x 4 Latin Square, with guard rows of cacao trees between each plot, were laid out in Field 8 for manurial trials. The *natural yield* of each tree has been recorded for two years (1932 and 1933). Fertilisers were applied in May and September, 1933, but crop records subsequent to manuring are not yet available.

II.—MARPER ESTATE.

38. *Cultivation.*—Every field on the estate was cutlassed twice and in addition Fields 1 to 5 were hoe-weeded. The latter was rendered necessary owing to gamelotte and other undesirable weeds having taken possession due to the reduction of Immortel shade trees for experimental purposes, in connection with Witchbroom control. This has also necessitated the planting of a large amount of ground shade. The ground shade planted during 1932 has grown fairly well and where necessary additional shade has been put in. All missing cacao trees were supplied during the year with seedlings raised from heavy bearing trees on River Estate. Young gardens have received continued attention and the whole cultivation is now in good order.

39. *Pruning.*—Every field was more or less lightly pruned from May to August, according to the condition of the trees. The pruning of Fields 1 to 5 where shade had been reduced for experimental purposes in connection with Witchbroom control, again consisted more in cutting out dead wood than actual pruning. Suckers were cut out in November and December.

40. *Draining.*—No systematic draining was necessary, but Fields 6 and 7 were drained where necessary. Several main drains and ravines were re-opened and the earth from all drains spread. The drains in Fields 8, 9 and 10 were cleaned with the hoe.

41. *Windbreaks and Hedges.*—These have continued to make good growth and are now well established. It is only a matter of time before they become effective.

42. *Thrips.*—Although the shade reduction programme was stopped after 1931, Thrips were still on the increase. A severe attack was experienced in December, 1932—Jauuary, 1933 on the 40-acre block comprising the shade reduction experiments, in Fields 1 to 5, causing a total change of leaf in February and the withering of a large proportion of the young fruit. In order to try and prevent a recurrence of these conditions it was decided to spray this area with Bordeaux Mixture. Spraying was started in April, when the new leaves were hardening, and completed in June. The treatment has been very successful. Thrips were scarce on this block throughout the latter part of 1933 whereas they were more plentiful on the balance of the estate. Adjoining properties and the District have been hard hit. In January, 1934, the trees have a dense and healthy foliage and a fair crop of fruit of all sizes whereas trees on other properties in the District are in young leaf and they carry a poor crop. The benefit derived from this spraying will be seen on the following crop.

43. Cacao Beetles, Squirrels and Rats were scarce and easily controlled. Black pods (Phytophthora) were very plentiful notwithstanding that pod shells were buried after each pick. The increase of black pods is due to the abnormally high and continuous rainfall during the year.

44. The rainfall on the estate for the year was 141.88 inches against 97.38 and 101.73 inches for 1931 and 1932 respectively. Three severe floods were experienced, two in November, one in December and several minor floods. On one occasion the water rose 9 to 10 feet in several sections of the Vega.

45. *Witchbroom.*—The usual monthly rounds were made and all diseased tissues cut out and burnt. The total number of diseased tissues found was 227,273 or 2,457 per acre an increase of slightly more than 7 per cent. on the previous year. The heaviest Witchbroom incidence occurred in March, when 83,557 diseased tissues were cut out and destroyed. The cost of cutting and burning diseased material was $5.07 and Supervision $1.13 per acre, a reduction of $1.00 per acre on previous years.

46. *Crops.*—The crop reaped for the year was 32,821 lb. of plantation cacao and 592 lb. of black cacao and siftings. The produce is disposed of through the Cocoa Planters' Association of Trinidad, Ltd. and the plantation cacao realised a new low record, viz. :—$5.73 as against $6.95 per fanega for 1932. The total crops (plantation and black cacao) in bags of 165 lb. for the four completed years, since the property was purchased, have been as follows :—

1930.	1931.	1932.	1933.
251	196	211	202

The decrease of crop coincides with the shade reduction programme for experimental purposes in connection with Witchbroom control and the increase of Thrips as a consequence of the shade reduction. As, however, the cutting out of further shade was stopped in 1932 and the 40 acres affected were sprayed with Bordeaux Mixture in 1933 as a preventitive against Thrips, it is hoped that the normal crop of 1930 will be obtained in 1934. The loss of crop due to matured Witchbroom pods is small and works out at less than 1½ per cent (*see* Experimental Section), for the plots on which records are being kept. Records for the whole estate are now being kept. The loss of crop due to small pods attacked with Witchbroom, which would otherwise have reached maturity, cannot be determined.

47. *Buildings, Yard and Stock.*—All buildings are in good repair. A 4,000-gallon concrete cistern, near the Manager's quarters, has been built by the Public Works Department and it is hoped that the larger cistern required for supplying water for the labourers will be put up during the coming year. Filling and levelling of the yard between the Manager's quarters and the stables have been completed. One of the mules met with an accident and had to be destroyed. It has since been replaced. The other is very old and will soon have to be pensioned.

48. *Roads and Bridges.*—A large re-inforced concrete bridge 35 feet long by 4 feet wide and 55 smaller bridges over drains and ravines have been built. The new road system, for crooking, started last year, has been extended and may be completed during the coming year.

Experimental Work.

49. The chief objects of the experiments are to ascertain the effect of the various treatments on Witchbroom incidence and on crop production. All results are given for the experimental year, *i.e.*, from 1st September, of one year to 31st August of the following year. *Crop yields are given in pounds of commercial cacao and Witchbroom incidence in numbers of affected material per acre.*

50. The experiments may be classified under four heads :—

(*a*) Cultivation Experiments.
(*b*) Manurial and Lime Experiments.
(*c*) Spraying Experiments.
(*d*) Other Experiments.

(a)—Cultivation Experiments.

51. These consist of draining and shade reduction on (*a*) flat lands or vega, and (*b*) on undulating lands. Details were given in the annual report for 1930. The first and second instalments of shade trees were cut out in 1930 and 1931, respectively, but as this treatment was found to be too drastic, from a cultural point of view, no shade trees were cut out subsequently. The drains were dug in 1930, re-opened in 1932 and cleaned out with a hoe in 1933. The average results for three years ending 31st August, 1933 are as follows :—

52. *Results on Vega.*

	50% *Shade Reduction.*		33⅓ *Shade Reduction.*	
	Crop.	*Witchbroom.*	*Crop.*	*Witchbroom.*
Drains 25 feet apart	440	5,626	355	3,243
Drains 50 feet apart	316	4,186	402	4,907
Drains 100 feet apart	175	1,464	197	1,341
No drains	201	2,369	271	2,306

(*a*) *Spacing of Drains.*—The results recorded above show that draining has had no effect in controlling Witchbroom. It should be pointed out that the plots showing the highest Witchbroom incidence are those adjoining the River and it is probable that their situation has a greater bearing on Witchbroom that the actual draining of the plots. With regard to crop production, the results show that lack of drains has adversely affected the crop.

(*b*) *Shade Reduction.*—The results tend to show that Witchbroom incidence is higher on the plots with greater shade reduction. With regard to crop production there is not much difference in the average yield for the plots on which 50 and 33⅓ per cent. of shade has been cut out, but the advantage is in favour of the smaller shade reduction.

53. *Results on the Undulating Land.*

	33⅓% *Shade Reduction.*		*No Shade Reduction.*	
	Crop.	*Witchbroom.*	*Crop.*	*Witchbroom.*
Drains 25 feet apart	355	2,663	305	1,662
Drains 50 feet apart	373	1,112	321	1,110
Drains 100 feet apart	204	1,397	422	1,312
No rains	280	2,082	392	1,192

(*a*) *Spacing of Drains.*—These results tend to show that the spacing of the drains has had no effect in controlling Witchbroom, on the undulating lands. The plots showing highest Witchbroom incidence are situated on the lower slopes and it is probable that the altitude and situation of the plots has a greater influence on Witchbroom incidence than the spacing of the drains. With regard to crop production the results tend to show that draining has had no effect on crop production, on the undulating lands.

(*b*) *Shade Reduction.*—The results show that there has been less Witchbroom where no shade has been cut. With regard to crop production, the results show a better yield for the section on which No Shade has been cut out.

(b) Manurial and Lime Experiments.

54. The Manurial and lime trials occupy 17 acres of land, partly vega and partly undulating, under ordinary shade conditions. Details of the trials are given in previous Annual Reports.

55. *Results.*—The average yields and Witchbroom incidence have been recorded for three years (1931 to 1933). The results show that none of the fertiliser treatments has had any effect on Witchbroom incidence. Each plot shows a similar curve for the three years. A report on crop yields is being prepared.

(c) Spraying Experiments.

56. The object of these experiments is to try and find an efficient fungicide for controlling Witchbroom.

Liquid Spraying.

57. Spraying with (*a*) Cooper's Fungicide and (*b*) Bordeaux Mixture, twice annually, (*c*) Cooper's Bordinette and (*d*) Vermorite, monthly, have been continued during the year.

58. *Results.*

Cooper's Fungicide and Bordeaux Mixture.—Spraying with Cooper's Fungicide or Bordeaux Mixture twice a year has not assisted in controlling Witchbroom. Both control and sprayed plots show a higher incidence than previously and small black pods bearing mushrooms were found on the sprayed plots.

Cooper's Bordinette and Vermorite.—Last year the plots sprayed monthly with Cooper's Bordinette and Vermorite, respectively, showed a decrease of Witchbroom as against an increase for their control plots. This year there is a further decrease in Witchbroom incidence for the sprayed plots and an increase for the control plots. No mushrooms were found on either of the sprayed plots during the past two years whereas mushrooms on small blackpods were found on both of the control plots in 1932. It would, therefore, appear that *monthly* sprayings with these fungicides has assisted in controlling Witchbroom.

Dusting Trials.

59. *Olite Sulphur.*—Monthly dustings with Olite Sulphur, at the rate of 20 lb. per acre, were continued throughout the year on a block of 8.2 acres containing 2,086 cacao trees. A slight decrease in Witchbroom incidence has been obtained both on the treated and control plots, but mushrooms were found on small black pods and on special brooms kept for observation.

60. *Cupryl Powder.*—The three plots treated with this copper-lime dust, monthly, at the rate of 20 lb. per acre showed a further increase in Witchbroom incidence. Mushrooms were found on small black pods and on brooms kept for observation. The treatments have been discontinued from the end of the experimental year.

Other Experiments.

61. These consist of :

(*a*) Topping or reducing height of trees.
(*b*) Picking off and destroying black pods on trees.
(*c*) Mature pods affected with Witchbroom.
(*d*) Percentage of trees not affected with Witchbroom.

62. *Reducing height of trees.*—The object of this experiment is to facilitate the search for and reduce the cost of cutting out Witchbroom, also to observe the effect on crop production. One acre containing the tallest cacao trees was divided into two equal parts. The cacao trees on one of the plots were topped in July, 1930, at 12 feet, and on the other at 16 feet from ground level. Two plots of one acre each, on either side of the treated plots, are kept as controls. At time of writing, three and a half years after the trees were topped, the new growth has practically attained the height of the original limbs cut off.

63. *Results.*—There has been no reduction in Witchbroom incidence for the topped plots compared with the control plots, for the three years, but the cost of cutting out Witchbroom from the topped plots has been slightly reduced. With regard to crop production, a decrease of about 40 per cent. was recorded for the first two years after topping, but a normal crop was obtained in the third year. The yield of the control plots has been normal for the three years. The slightly lower cost of searching for and cutting out Witchbroom does not compensate for the loss of crop recorded.

64. *Picking off Black Pods.*—Apart from specially labelled brooms, mushrooms on Marper Estate, where brooms are cut out monthly, have been found only on immature or small black pods on the trees and on the ground. In order to ascertain the cost and effect of ridding the trees of these black pods two plots of slightly more than half an acre each were worked quarterly in 1932. No Mushrooms were found on small black pods on these plots, but the cost, $5.70 per acre, of collecting and destroying the pods is too high for practical purposes. With a view to reducing the cost, these plots were worked only twice during the year, viz. : in July and November at an average cost of $2.27 per acre. The number of pods collected and destroyed in 1932 and 1933 is 10,536 and 2,490 respectively. The lower number of pods for 1933 is undoubtedly due to self shedding of the pods before the cleaning up was done. Not only has the cost been reduced 60 per cent. but the results show that the work has been useful as no mushrooms were found on these plots. No hard and fast rule can, however, be laid down as to the best time for carrying out these operations. Withering of chirelles and weather conditions should be observed. Generally, July-August and November-December appear to be suitable periods for carrying out the operations.

65. *Per cent. Mature Pods Affected.*—In order to ascertain the loss of crop due to mature pods affected with Witchbroom, records from several plots have been kept during the past three years. Plots which, owing to their situation, were expected to yield high, medium and low incidence were selected.

66. The average results for three years to 31st August, 1933 are as follows :—

	Total Pods.	*Affected Pods.*	*Per cent. affected.*
High Incidence.			
Four plots (3 years)	3,856	105	2.67
Medium Incidence.			
One plot (3 years)	3,319	51	1.54
Low Incidence.			
One plot (3 years)	5,880	30	0.51

From the above it will be seen that the loss of crop, at Marper, due to mature pods affected with Witchbroom is small and based on the records of the above plots which has not exceeded 1½ per cent. Records for the whole Estate are being kept from 1st September, 1933 and the results for five months to 31st January, 1934 show a loss of 1.25 per cent. from mature pods affected with Witchbroom.

67. *Trees not affected with Witchbroom.*—Records of Witchbroom incidence are being kept for 4,289 individual trees, in the Manurial Section. From these records it is possible to ascertain the number of trees which have not been affected with Witchbroom, on vega and on undulating lands. The number of trees which has not been affected with Witchbroom in any one of the past three years are given below :

		Trees in plot.	*Not affected trees.*
Lime Series	(Vega)	250	0
Nitrogen Series	(do.)	501	1
Nitrogen and Potash	(do.)	500	0
Nitrogen and Phosphate	(do.)	504	1
Potash	(Undulating)	510	6
Phosphate	(do.)	512	11
Complete fertiliser	(do.)	501	18
Lime	(do.)	504	29
Potash and Phosphate	(do.)	507	139

68. From the above it will be seen that out of 1,750 trees in the *vega*, only two have so far been free from Witchbroom during the past three years, viz. :—Tree No. 1686 in the Nitrogen Series and No. 724 in the Nitrogen plus Phosphate Series. Tree 1686 is rather small, not too vigorous and a poor bearer ; the pods are red and small. Tree 724 is a big, vigorous tree and a medium bearer (33 pods per annum). The pods are yellow, of medium size and the beans small to medium. Seed from these trees have been sown in highly infested areas to see whether their progeny will be immune to Witchbroom. Twenty-four other trees which have so far shown high resistance to Witchbroom, *i.e.*, one to four brooms during three years are being kept under close observation.

III.—MANURIAL EXPERIMENTS ON PRIVATE ESTATES.

69. These experiments are being made under the supervision of the Department of Agriculture, in co-operation with Messrs. Imperial Chemical Industries, Ltd., who supply the fertilisers, but the cost of keeping records and of applying the fertilisers is borne by the proprietors.

Manurial Experiments on Coconuts.

70. *Experiments at Endeavour Estate.*—This Estate is situated at Chaguanas and is typical of a large area of old sugar-cane land in coconuts. The soil is flat, deep, well drained and varies from a sandy loam to a clay loam. The trees come into bearing late but yield an average crop of 3,000 to 4,000 nuts per acre, when they are 18 to 20 years old.

71. *Experiments with Sulphate of Ammonia.*—These were started in December, 1925, on trees 13 to 15 years old. The experiments are being made on whole fields, 8 to 9½ acres each, whose cropping records previous to manuring are known. The object is to ascertain the pecuniary benefit of a normal dressing of Sulphate of Ammonia alone, and in combination with Potash and Phosphate. The fertilisers were applied every second year from December, 1925 to 1933, at the following rates per acre :—

Field 1	..250 lb. Sulphate of Ammonia.
Field 7	..250 lb. Sulphate of Ammonia. ..100 lb. Sulphate of Potash.
Field 4	..250 lb. Sulphate of Ammonia. ..150 lb. Rock Phosphate. ..100 lb. Sulphate of Potash.
Field 2	..Control—No manure.

72. The average annual rainfall on the Estate for the past two years was 72.14 inches and for the previous five years 65.84 inches.

73. The average yields obtained for the first period of five years (1927-31) and for the subsequent two years (1932-33) after manuring, respectively, have been worked out with the object of ascertaining whether the results of the first five-year period will be maintained or bettered during the subsequent five years.

74. In working out the results, coconuts have been valued at $14.50 and $9.30 per 1,000 for the two periods 1927-31 and 1932-33, respectively, being the average price realised for the produce for these periods. Similarly, the cost of manuring has been computed from the actual cost of the fertilisers and of their application for each period.

75. *Results.*—All the fields have given an increased yield for the five years (1927-31) and for the two years (1932-33) above their respective *natural yields* for five years previous to manuring. But the increase shown by the manured fields (Nos. 1, 4 and 7) is 702, 490 and 318 nuts per acre per annum for the five years (1927-31) and 1,419, 233 and 670 nuts for the two years (1932-33), respectively, after manuring, over and above that of the control field. The pecuniary results per acre per annum for the two periods are as follows :—

	5 years average, 1927-31.	*2 years average,* 1932-33.
Field 1 (Sulphate of Ammonia only)	$ 6.59	$ 11.17
Field 7 (Sulphate of Ammonia plus Sulphate of Potash) ..	2.10	—1.10
Field 4 (Complete fertiliser)	—1.06	2.29
Value of nuts per 1,000	14.50	9.30

From the above it will be seen that the beneficial results due to manuring with Sulphate of Ammonia have not only been maintained but that they have been further enhanced, during the second period, notwithstanding the drop in price of the produce.

IV.—EXPERIMENTS IN CONNECTION WITH COCONUT WILT.

76. The series of experiments started in 1931, on the Perseverance Section of the Waterloo Estates, with a view to throwing light on the cause of the Wilt disease of coconuts consist of :—

(*a*) Manurial Trials.
(*b*) Trimming of leaves and firing of crown of palms.
(*c*) Preserving moisture during dry season.
(*d*) Removing the crop from the palms.
(*e*) Dusting trials.

Regular inspections were made of the plots and records have been kept of wilt affected trees.

77. *Manurial Trials.*—These are being made in two sections :

(*a*) Field 1, Felicite Hall.

(*b*) Fields 1 and 2, Notice Board.

The object of this experiment is two-fold. Firstly to determine the effect on Wilt incidence and secondly to ascertain the results on crop production.

78. *Field 1, Felicite Hall.*—The plots were marked out in December, 1930, and the palm trees were then about 18 years old. The northern section of the field had been and was still seriously affected by Wilt.

79. *Lay out.*—The plots were laid out in the south-eastern section of the field which was free from Wilt at the time. There are four blocks or replicates of random plots. Each plot consists of two beds containing three palm trees each. The plots are separated from one another by drains along the beds and a guard row of palm trees across the beds. Two applications of fertilisers were made, in July, 1931 and May, 1933, respectively.

80. *Results.*—No Wilt affected trees have, so far, been found on any of the plots, but Wilt has been spreading towards the plots. Crop results from the manurial treatments will be dealt with in a separate paper, but it may be mentioned that large increases in crop have been obtained from the manurial treatments.

81. *Fields 1 and 2, Notice Board.*—The plots in these fields were also marked out in December, 1930. The palm trees were approximately 10 and 8 years old in Fields 1 and 2 respectively. Apart from yellowing and browning of leaf the trees appeared to be otherwise healthy, though backward for their age.

82. *Lay out.*—There are four blocks or replicates of random plots. Each plot consists of two beds containing two palm trees each. The plots are separated from one another by drains along the beds and a guard row of palm trees along the beds. There is a control plot between each treated plot.

83. *Treatments.*—(*a*) Field 2 Notice Board :—

Plot 1	..	5 lb. Sulphate of Ammonia per tree.
Plot 2	..	7 lb. Superphosphate of Lime per tree.
Plot 3	..	3 lb. Sulphate of Potash per tree.
Plot 4	..	5 lb. Sulphate of Ammonia per tree. 3 lb. Sulphate of Potash per tree.
Plot 5		15 lb. Fish Guano per tree.
Plot 6	..	5 lb. Sulphate of Ammonia per tree. 7 lb. Superphosphate of Lime per tree. 3 lb. Sulphate of Potash per tree.
Plot 7	..	280 lb. Pulverised Limestone per tree.
Plot 8	..	Megass Mulch.
Plot 9	..	480 lb. Pen Manure.

The Limestone and Pen Manure treatments work out at approximately 9 and 15 tons per acre, respectively. Limestone was applied in May, 1931 and the fertilisers in July, 1931 and 1933. The treatment for plot 8 was not carried out.

(*b*) Field 1 Notice Board received double the above treatments at the same time as above.

84. *Results.*—(*a*) Field 2 Notice Board.—No Wilt trees were observed until the latter part of 1933 and in January, 1934, 19 trees had died from Wilt as follows : seven in the control plots, four in plot 8 (which as previously mentioned was not treated), five in the guard rows and one each in plots 1, 2 and 4. There has been a much higher Wilt incidence on the Control and untreated plots than on the fertilised plots, which tends to show that there is probably a correlation between Wilt and plant-food deficiency.

(*b*) Field 1 Notice Board.—No trees have died from Wilt.

85. *Trimming of leaves and firing of crown of palms.*—This experiment consists of :—

(*a*) Cutting off the yellow leaves of trees showing signs of Wilt.

(*b*) Firing the crown of the palms to burn off dry material without destroying the bud, and

(*c*) Control, no treatment.

The plots were marked out in December, 1930, in the central section of Field 1 Felicite Hall, adjoining the northern section which was seriously affected by Wilt. The trees were 18 years old in 1931 and 16 trees within the plots had died, previously from Wilt.

86. *Lay out.*—There are four replicates of a 3 x 3 Latin Square. Each plot contains four palm trees, so that there are 48 trees for each treatment.

87. *Results.*—In 1931, nineteen trees showed signs of Wilt, of which fifteen died. Two wilted trees out of five recovered after cutting off yellow leaves, two out of seven recovered after firing the crown of the palms but none of the seven affected trees in the Control plots recovered. The cutting back of the leaves or firing of the crown should be done before the disease is too far advanced to ensure a reasonable chance of success. Four of the trees that died were treated when they were too far gone.

In 1932, two trees only showed signs of Wilt in the plots from which the leaves are to be cut off, one died and the other recovered. No trees in the other plots showed signs of Wilt.

In 1933, one tree each in the plots from which yellow leaves are to be cut off and the crown fired showed signs of Wilt. Both trees recovered after treatment. No trees showed signs of Wilt on the control plots.

88. *Preserving moisture during dry season.*—This comprises two distinct experiments :

(*a*) Preserving moisture by mulching.

(*b*) Preserving moisture by filling drains.

89. *Preserving moisture by mulching.*—The experiment is being made on the South-western section of Field 1, Felicite Hall, on trees 18 years old in 1931. The plots are due west of the manurial experiments described in para. 78. They were marked out in December, 1930, and the treatments consist of :

(*a*) Weeding at the beginning of the dry season so as to have an earth mulch.

(*b*) Mulching with grass &c.

(*c*) Control, no treatment.

90. *Lay out.*—There are four replicates of a 3 x 3 Latin Square. Each plot contains four palm trees, and there are therefore 48 trees for each treatment. The weeding was done annually from 1931 and the mulching in 1932 and 1933.

91. *Results.*—One tree only, on the weeded plots, showed signs of Wilt in 1932 and died.

92. *Preserving moisture by filling drains.*—Two fields known as 13 and 18 Felicite were selected for this experiment. The trees were 13 and 14 years old in 1931 and several trees had previously died from Wilt. There are two treated and two control plots in each field. Each plot consists of three beds with an 18 inch drain between each bed. There are seven palm trees in each bed or 21 trees to a plot giving 42 trees under treatment in each Field with a similar number of trees in the control plots.

93. *Treatment.*—The drains in the treated plots are being gradually filled in by raking into the drains the grass, leaves and husks after each cutlassing and scraping a small amount of earth from the centre of the beds.

94. *Results.*—Two trees, on the treated plots, in Field 13 and one in Field 18, died from Wilt in 1932. No other trees have shown signs of Wilt.

95. *Removing the crop from palms.*—A block containing 118 bearing trees in the eastern section of Fields 12 and 17 Felicite Hall was marked out in September, 1931. Several trees had died from Wilt in these fields but the incidence was greater in the western Section. In September, 1931, all the nuts from alternate bearing trees were cut off with the object of ascertaining whether relieving the palms of their crops would render them less susceptible to Wilt.

96. *Results.*—When the plots were marked out one tree from which the crop was removed showed signs of Wilt. This tree eventually died but no other tree has, so far, had Wilt.

97. *Dusting Trials.*—Dusting trials with Cupryl Powder and Olite Sulphur were made in a heavily wilted area during 1931 and 1932. The results were negative and the treatments have been discontinued.

V.—GENERAL.

Analytical Work.

98. *Testing of Government Farm Milks.*—During the first six months of the year 790 samples of milk from the cows at the Government Farm were tested for butter-fat. Samples of the morning and afternoon milkings of each individual cow and of the mixed milk supplied to Government Institutions were tested once a month. The results for the individual cows are recorded in the herd book at the Farm. The butter-fat content of the mixed milk from January to June, 1933, was 3.46 and 4.52 per cent. for the morning and afternoon milkings respectively.

Hurricane of 27th June, 1933.

99. Most of my time from July to the end of October was taken up with work in connection with the hurricane which visited the south of the Island on 27th June, 1933. With a view of ascertaining the extent and intensity of the damage done on each property the devasted area was divided into three sections Mr. F. Bain being in charge of the Icacos-Cedros District, Mr. R. J. Foster of the Erin-Siparia District and the Agronomist of the Moruga District. The Agricultural Advisers of these Districts and twelve Witchbroom Inspectors were enrolled to assist in making the survey. Loans not exceeding $2.50 per acre based on this survey, were made by Government to assist cacao proprietors in clearing the damage. These loans were subsequently converted into gifts.

100. The following is a summary showing the extent and intensity of damage done.

Summary of Cacao Properties.

Ward.	No. of Proprietors.	Total Acreage.	Damaged area in Cacao.			Not damaged.	Area in Coffee.	Area in Coconuts.	Area in Citrus.	Uncultivated and abandoned.
			Heavy.	Medium.	Light.					
Moruga	316	11,471	4,767	1,273	1,271	1,194	508	1,100	57	1,301
Siparia	325	9,660	1,366	1,975	2,229	1,589	17	480	16	1,988
* Erin	196	10,062	4,443	912	473	120	153	771	242	2,948
Cedros	379	6,155	1,850	1,211	276	123	..	861	..	1,834
Grand Total	1,216	37,348	12,426	5,371	4,249	3,026	678	3,212	315	8,071

* Including part of Cedros.

Note.—The areas planted in Coffee, Coconuts and Citrus in the Moruga and Siparia Wards were only slightly damaged whereas the damage was light to medium in the Wards of Erin and Cedros.

Summary of Coconut Properties: Cedros and Icacos.

Class.	No. of Proprietors.	Total Acreage.	Damaged area in Coconuts.			Area in Citrus.	Uncultivated or abandoned.
			Heavy.	Medium.	Light.		
1- 10 Acres	67	327	200	54	50	..	23
11- 50 ,, ...	18	347	242	14	55	..	36
51- 100 ,, ...	3	204	123	..	80	..	1
101- 200 ,, ...	2	279	91	129	..	..	59
201- 500 ,, ...	2	709	..	..	709	..	..
501-1,000 ,, ...	4	3,200	2,167	841	..	..	192
Over-1,000 ,, ...	2	3,100	1,086	..	1,800	140	74
Total	98	8,166	3,909	1,038	2,694	140	385

Note.—The figures in this table are to be read as follows:—Class 1-10 acres, properties totalling 200 acres were heavily damaged, properties totalling 54 and 50 acres suffered medium and light damage, respectively.

101. The Agronomist also devoted much time to preparing estimates of costs for re-establishing damaged cultivations and planting new crops in the damaged zone. These served as a guide to the Committee when considering applications of proprietors for advances under the Agricultural Industry Hurricane Relief Ordinance, 1933. The applications of several proprietors were also revised and redrafted for the Committee.

J. De VERTEUIL,
Agronomist.

VERNMENT STOCK FARM, TRINIDAD—REPORT, 1933.

General.

Mr. J. H. Brooks, the clerk at this Institution, proceeded to England on leave on 11th July and resumed his duties on the 1st October, the date of his return to the Colony. During his leave his duties were performed by Mr. C. N. Cherrie (4th Class Clerk) of the Head Office of the Department.

2. The rainfall for the year was extremely high, 88.47 inches, and the St. Joseph River was frequently in flood during the rainy season, overflowing its bank on three occasions and causing large areas of the Farm to be completely under water for several hours. The lowest rainfall recorded was 1.01 inches in February and the highest 13.31 inches in September. The roads and traces on the Farm were badly cut up by this heavy weather and the work of the cart animals—oxen and mules—considerably increased as a result. As soon as weather conditions permitted towards the end of the year a start was made to repair these roads by putting on gravel.

3. There was good grazing during the year and the dairy herd was turned out all night as well as during the day. The approaches leading to the Pastures were in bad order owing to the weather and this caused considerable amount of foot trouble in all the cattle. The Zebu herds remained at pasture day and night but were brought in once daily into the dairy stanchions to be fed their concentrates as well as to be handled. The good grazing was made full use of also for horse-kind, the brood mares being turned out either during the day or at night time. The continuous rains, however, gave rise to a form of dermatitis in most of the mares but the condition, which was also observed in other parts of the Colony, disappeared as soon as the weather improved.

Water Supply.

4. The Public Works Department carried out extensive repairs to our new water supply. It was found necessary to cut down the bank of the river on one side and to extend and, at the same time, raise the height of the dam in order to get a free flow of water to the intake pipe. In spite of heavy floods no damage was done to the dam this year and the only inconvenience experienced was the silting up of sand around the intake pipe which at times was almost a daily occurrence. The Blake's Ram worked most satisfactorily.

Cattle.

5. No new cattle were imported during the year. Two pure bred Holstein bulls were purchased from Macqueripe Estate, one full grown and the other a bull calf. The pure bred imported Holstein cows are now holding their condition better and appear to have become acclimatized. The two pure bred native born Holstein cows are proving to be regular breeders and are quite hardy. There are now two second generation pure bred Holstein heifers in the herd, and following Jamaican experience, it is hoped that third generation local born pure breds will prove to be able to give more satisfactory yields of milk, characteristic of their ancestors in temperate countries. One of the imported Holstein cows, Leta Victoria produced twin heifers during the year by King Butter Girl Walker; both of which have developed into sturdy very promising heifers. King Butter Girl Walker (calved in 1921) has maintained his good health, condition and fertility under the system of being kept continuously at pasture, while receiving there a ration entirely of crushed Indian corn. This bull in addition to producing several pure bred calves, has also sired a number of in-bred calves from his half and three-quarter bred daughters. Incidentally it should be recorded that King Butter Girl Walker sired twins, a bull and a heifer, from his half bred daughter, Maybell. The bull was sold for a good price at the last Annual Sale, and the heifer has been retained in the hope that she may prove to be one of the rare exceptions—a fertile free martin. Royal Duke died during the year and, since he had proved to be equally successful as his sire, King Butter Girl Walker, it was found possible to replace him temporarily by his half brother—Rutchers II—by Rutgers King Sadie Vale de Kol out of Duchess, by lending another pure bred bull to River Estate.

6 The pure bred Sussex cattle have proved very hardy under local conditions. The bull takes his turn with all the other bulls on the farm, regularly under the yoke, and is very fertile. There are now three pure bred bulls, father and two sons, and two pure bred cows and two heifers or a total of seven pure breds of which four are local born. Several of the half bred Sussex heifers are expected to produce three quarter bred calves shortly.

7. The breeding of the Holstein-Zebu grades from half to seven-eighth bred to Royal Duke has been continued and since his death to Rutgers II. The daughters of King, which have produced bull calves, have been re-bred to King Butter Girl Walker in the hope of obtaining more in bred heifers by this tested sire.

8. The dairy zebu herd is progressing satisfactorily and the bull used last year has been replaced by one whose dam is a better milker than the dam of the previously used bull, and whose full sister has bred as early as European dairy stock, and has milked without her calf, exhibiting proper dairy temperament.

9. The working of all bulls has been continued and the results have been satisfactory. The two Zebu bulls at the head of their respective working and dairy herds, and King Butter Girl Walker are the only three bulls that are not worked because they are kept continually at pasture.

10. Thirty-three privately owned cows were bred to pure bred bulls on the Farm during the year at a service fee of $2.00. This number is considerably lower than in past years and is due to the fact that grade bulls are being more conveniently used in the dairy district around the Farm. It is intended to take steps at an early date to replace these bulls by pure bred bulls. A pure bred Holstein Friesian bull was hired to the Ste. Madeleine Sugar Co., for service in the district during the year and the imported pure bred Holstein Friesian bull 'Segis Echo Rooker' was given to Waterloo Dairy in exchange for the imported bull 'Prince Johanna Hartog'

11. At the Annual Sale held on the 15th December, four grade cows averaged $82.00, 21 grade heifers averaged $44.00 and four grade bulls averaged $70.00. A pure bred Holstein bull calf fetched $50.00. A grade bull (seven-eights Holstein Friesian) was sold privately for shipment to Venezuela for $240.00 and also one grade bull (half bred Sussex) for $100.00 for shipment to British Guiana. Three pure bred Zebu heifers averaged $62.00 at the Annual Sale and one pure bred Zebu bull was sold for $360.00.

12. For the convenience of the dairy in districts around Port-of-Spain four pure bred Holstein Friesian bulls and two selected grade bulls of the same breeding stood for service at the Bulls' Service Station of the Department, Mucurapo. Two of these pure bred bulls were turned out to pasture—one at Mucurapo and one at St. Ann's—every night during the year. At the Station 36 cows were bred to pure bred bulls during the year and 233 cows to grade bulls.

13. There was a liberal supply of grass on the Mucurapo and St. Ann's Pastures during the year and the average daily number of head of cattle, cows and heifers in these pastures were 68 and 30 respectively. These cows and heifers were all entitled to free service as pure bred bulls were turned out into the savannah every evening.

14. The Department continued to rent the small paddock at St. Ann's, north of the St. Ann's Pasture, to a private individual at a monthly rental of $5.00.

15. *Dairy Herd.*—The amount of milk produced during the year was 33,235 gallons or 2,125 gallons more than last year—this does not include the amount fed to calves—The Public Institutions were supplied with 31,408 gallons, 3,200 gallons more than in 1932.

16. The daily recording of the milk yield was entered on special milk sheets and the weekly totals then transferred to a record book. The milk of each cow was tested for butter fat every month by the Agronomist but the work was stopped towards the end of the year as this Officer was employed on special work in the Department. The butter fat content in the mixed milk of the herd averaged 3.5 per cent. in morning milk and 4.5 per cent. in afternoon milk.

17. *Zebu Herd.*—The following animals have been sold privately during the year from the herd :—

1 pure bred Zebu bull calf and two pure bred Zebu heifers to Mr. E. Murray	$ 312.00
2 pure bred Zebu heifers to Mr. R. Melizan	175.00
3 young pure bred bulls to Mr. F. Castro	660.00
1 young pure bred bull to Mr. F. Castro	200.00
2 young pure bred bulls to Mr. De Pompignon at $216.00 each	432.00
	$1,779.00

This amount, $1,779.00 plus $546.00, the amount realised for this class of stock at the Annual Sale, brings the total to $2,325 or approximately £500 for the sale of pure bred Zebu cattle for the year.

18. *Calves.*—During the year 112 cows calved normally and 10 cows aborted. All calving cows were kept in for 21 days after parturition and aborting cows were segregated in special stables for six weeks before they were returned to the herd.

19. *Health.*—Owing to weather conditions the health of animals on the Farm was not as satisfactory as in former years. There were 36 deaths and 12 of these were in calves due to parasitic gastritis, three to pneumonia and five to calves that were born to time but very weak. Other causes were: two due to difficult parturition, four from old age and debility and the pure bred Holstein Friesian bull 'Royal Duke' died from heat stroke.

Horsekind.

20. The thoroughbred stallion 'Golden Eaglet' purchased in 1926 was destroyed in February due to orchitis. Golden Eaglet was insured for £100 and he was replaced by 'Lundy Light' (foaled in 1925) a grey horse by Tetratema out of Star of Light by Sunstar that cost £235 landed in the colony—the Farm paying the difference of £135. Lundy Light was sent out by the British Blood Stock Agency in June and was formerly owned by Lord Lonsdale. Lundy Light has a very good turf record as he was a winner in England as a two, three, four, five, six and seven year old. He won ten races valued at £2,125 and such a fashionable bred horse will be a further acquisition to our horse breeding. The thoroughbred stallion 'Daddy' was stationed in Tobago for the whole of the season, leaving Trinidad on 31st January and returning on 9th November. The thoroughbred stallion 'K. P." stood for service at the Farm, Trinidad, and served 12 mares. K.P. left Trinidad for Tobago in November to take Daddy's place for the 1934 season. The thoroughbred stallion Bachelor's Tut, that stood for service in Tobago in 1932, returned to Trinidad early in the year (February) and stood for service at the Farm, where he served ten mares and at Brechin Castle, Couva, where six mares were sent to his court. The fee charged for the services of these stallions in Trinidad was $10.00 each plus 60 cents grooms fee. The Jack Donkey Stallion 'Emperor 2' served 13 mares at a service of $7.50 each plus 60 cents grooms fee. Two smaller donkeys, Barbados Joe 2 and Big Six were purchased locally for donkey breeding. Barbados Joe 2 served six jennies at $1.00 each and Big Six five jennies at the same service fee. Barbados Joe 2 when tried served mares as well as jennies willingly and was sold to the Grenada Government for mule breeding on the island of Carriacou for $192.00.

21. The thoroughbred brood mare Bois de Rose aborted following an acute attack of laminitis and had to be destroyed. The thoroughbred mare Saturnia foaled a colt foal by K.P. but this foal died due to digestive troubles. Saturnia was bred to Bachelor's Tut and was heavy in foal at the end of the year. The thoroughbred mare Barbara was given to the Farm by Mr. Eugene Herrera on condition that the first foal was given to him when weaned: she was bred to the stallion K.P. but was not in foal when the breeding season closed. The thoroughbred mare Miranda was transferred from the Constabulary to the Government Farm for breeding purposes in December and will be bred to Bachelor's Tut next season.

22. The old half bred mares Nellie and Cavel both foaled during the year a colt and a filly respectively, the former by K.P. and the latter by Bachelor's Tut. Nellie was bred to K.P. this year and Cavel to Bachelor's Tut and they were both heavy in foal at the close of the year. The filly foal by K.P. out of Cavel was sold at the Annual Sale for $50.00, but Nellie's colt was withdrawn at the Sale as the reserved price was not reached. The brood mares Wistaria, Pretty Polly and Marama all foaled during the year—the former a colt by Bachelor's Tut that is to be transferred to the Constabulary and the others mule fillies by Emperor 2. The two latter were re-bred to the Jack Donkey and Wistaria to K.P. and they all proved again. The two mule fillies were sold at the Annual Sale at a price of $50.00 each. The brood mare Andiquilla died during the very wet weather following parturition trouble and Maraquita that failed to hold in 1932 showed signs of being in foal at the end of the year.

23. During the year three large jenny donkeys, two of which are pure American breeding and the other a three quarter bred, were purchased with the idea of breeding large Jack Donkeys at the Government Farm. They were all bred, as well as two common jennies and they should foal in 1934.

Pigs.

24. Owing to the death of our Berkshire Boar, it was necessary to transfer a boar of this breeding to Trinidad from Tobago. A young Berkshire Boar and a gilt in pig were imported from Canada during the year. A young Large Black Boar was reared out of one of the imported sows that farrows a large litter, for service purposes at the Farm.

25. During the year 16 sows were bred to pure bred boars at the Farm at $1.50 each.

26. At the Annual Sale 25 young pure bred Berkshire and Large Black pigs fetched $249.50, an average of approximately $10.00 each. The highest price paid was $23.00 for a Large Black sow and $22.00 for a Large Black boar.

27. Private sales of young pigs during the year amounted to $365.00 making a total of $614.50 for the sale of pigs during the year.

Dairy and Mutton Goats.

28. The Saanen Buck Prince Perfection was loaned for service in the Rio Claro district under the care of J. Bhagan, an enthusiastic goat keeper. Prince Perfection bred the does on the Farm before being sent to Rio Claro.

29. At this year's Annual Sale, one Saanen and four Indian goats were sold, realising $30.00.

30. The Indian Lop-eared buck sent to Tobago has grown into a splendid large specimen and is greatly in demand, so that the request has been made that additional bucks of this kind should be stationed in Tobago as soon as available. A young doe of this breed has also been added to the Tobago Farm, and a Saanen buckling.

31. The imported British Alpine Buck Didgemere Raven has superceded Prince Perfection on the Farm and besides breeding all the Farm does which kidded during the year, 34 privately owned does were bred to Didgemere Raven at $1.50 each. The other imported British Alpine Buck Whitwell Dido has been stationed at Mucurapo Stables for the convenience of goat breeders in Port-of-Spain. A young Indian buck has also been sent to Mucurapo.

32. The pamphlet (Shannon) on dairy goats, published by the Department, has been readily bought by goat keepers, and Muir Marshall & Co. have sold out their first stock of copies.

Black Head Persian Sheep.

33. At the Annual Sale a ram lamb six months old and a young ewe with ram lamb at foot were sold for $100.00. The imported ram was sold during the year for use in the Northern Islands, and a good son kept in his place. The ram in Tobago is still doing valuable service, and a number of splendid offspring may be seen there from local ewes.

Poultry.

34. During the year there were imported from Cook's Poultry Farm at Orpington, England, two pens Plymouth Rocks, one pen Rhode Island Reds and one pen White Leghorns, which were received on 13th May.

35. At the Annual Sale, 56 lots of pure bred poultry were sold—a total of 112 birds realizing $250.80. The number of eggs laid during the year was 6,867 and the revenue from sale of eggs was $187.85.

36. Two incubators were purchased during the year bringing the number to three now in operation on the Farm, one Gloucester and two Hearson's.

37. The breaking up of breeding pens, during moulting season, was again tried for the second year in succession with the same good results as last year, as shown by high fertility and strong chicks, when pens are mated up at the close of the moulting season. The low mortality of chicks hatched from November to February inclusive, proves that all hatching should be done in Trinidad during these months and infertile eggs for eating should be produced from the majority of hens for the remainder of the year. A few of the best hens would supply out of season hatchings to those who care to persist when mortality as a rule is very high in chicks locally. The rearing of chicks on wire up to the age of eight or ten weeks has again proved very successful.

Sale of Stock.

38. The Annual Sale took place on the 15th December, 1933 and the amount realised was $2,907.30. Private sales amounted to $2,744.39, making a total of $5,651.69 for the year or $830.12 more than 1932.

Pasturing and Stabling.

39. There was no general pasture at the Farm offered to the public again this year, but arrangements were made for the pasturing and stabling of mares, jennies, cows and heifers sent to be bred to the stallions, jacks and bulls. Stabling accommodation was also provided for sows, ewes and does sent for breeding purposes. The revenue derived from the pasturing and stabling of animals amounted to $1,117.47.

Fodder Plants.

40. As in previous years all horses were fed grass from our cultivated grass fields during the whole year. The cattle were only fed grass during the rainy season and Uba cane and cane tops from the seedling varieties of canes during the dry season. The Constabulary horses were supplied with grass during the rainy season and with Uba chop chop during the dry season. Small quantities of grass were also sold privately during the rainy season. The revenue for sale of fodder was $2,404.32.

Uba Cane.

41. Less Uba was used this year than in previous years and the fact was demonstrated that 'stand over' Uba makes very satisfactory food, as was proved when Uba chop chop was used towards the end of this year. The heavy rainfall during the year destroyed a large proportion of the Elephant grass and so reduced the tonnage of fodder from the cultivated grass fields, making it necessary to fall back on Uba.

Sugar Cane.

42. Crop started on 6th March and ended 19th April. 515¾ tons were sold to the Imperial College Factory and 163¼ tons to the Orange Grove Estate. The revenue from sale of canes was $1,955.41.

Coconuts.

43. The coconut plots have as usual been treated as grass fields, receiving a heavy dressing of manure direct from the dairy and horse stables to compensate for loss of grass removed for fodder. The dwarf coconut plot was further extended and some seeds of the green variety were sold during the year. The revenue from the sale of coconuts during the year amounted to $277.55.

Visits, Educational Work, Meetings, &c.

44. The following were among the visitors to the Farm during the year: The West Indian Federation Committee; Mr. Cook, the well known poultry breeder of Orpington, Kent; Mr. C. W. H. Glossop, M.P., a breeder of Holstein Friesian cattle in England; the Consul for France; the Trade Commissioner for Uruguay; the Venezuelan Consul and party and the Principal, with the Professor of Agriculture, and the students of the Imperial College of Tropical Agriculture. Sanitary Inspectors also attended the Farm for lectures and demonstrations.

45. Arrangements were also made for Boy Scouts from British Guiana, Grenada and St. Lucia attending the West Indian Jamboree to visit the Farm, the following schools also had an outing for a day at this Institution: St. Ann's R.C., Inverness C.M. (children and parents), Couva E.C., Arima Government School and the Wesleyan Sunday School children from the Naparimas.

Buildings and Improvements.

46. A maternity ward for cows was constructed during the year by the Public Works Department, consisting of ten calving stalls imported from Beatty Bros, Canada..

Revenue.	£	s.	d.
Sale of Stock..	1,177	8	8½
Sale of Canes	407	7	6½
Sale of Milk and Eggs ..	4,071	11	3½
Stud Fees	175	18	9
Stabling and Pasturage ..	361	4	0
Miscellaneous	801	8	5
£	6,994	18	8½

Expenditure.	£	s.	d.
Personal Emoluments	710	0	0
Maintenance	2,404	8	6½
Gatekeeper, Trinidad Government Railway	25	0	0
Travelling	17	18	9
Motor Lorry Expenses	249	16	1
Expenses of Annual Sale ..	24	4	2½
Grass Land Experiments ..	29	19	3
Materials	379	13	10
Stock—Purchase	624	16	7
—Feed —Purchase of ..	1,349	19	2½
—Expenses of Stallions ..	149	18	8½
£	5,965	15	2

H. V. M. METIVIER.

REPORT OF THE VETERINARY DIVISION.—1933.

General.

The Com nittee with the Director of Agriculture as Chairman appointed in 1932 to report on the incidence of paralytic rabies and to make recommendations for the control of the disease, submitted their report early in the year. This report was considered in London in July by the Colonial Advisory Council of Agriculture and Animal Health, who endorsed the full programme of work recommended :—

(1) Vaccination of animals on an extensive scale.
(2) Research bearing on the transmission of the disease.
(3) Study of bats.
(4) Record of deaths.

Dr. W. H. Andrews, the Director of the Imperial Bureau of Animal Health, submitted an interesting interim report at this meeting on his researches with this rabies virus carried out at Weybridge and has promised a further report shortly.

2. A small Committee consisting of the Surgeon General (Chairman), the Director of Agriculture (Acting), the Government Bacteriologist, the Government Veterinary Officer and the Assistant Medical Inspector of Health (Secretary), was appointed by Government to deal with the recommendation of the Rabies Committee and during the year two meetings of this body were held.

3. The Veterinary Officer stationed in Tobago was transferred to Trinidad in May and posted in the southern part of the Colony (San Fernando) to assist in the vaccination campaign against paralytic rabies. He was removed to St. Joseph in November, as paralytic rabies has subsided in the south, to assist in the tuberculin testing of dairy cows in rural districts around the city of Port-of-Spain.

4. It was also arranged that the Assistant Officer-in-Charge of the Government Stock Farm, Trinidad, who is a qualified Veterinary Surgeon should also assist in the vaccination against rabies in the northern part of the island.

5. Professor F. W. Urich (Zoologist) of the Imperial College of Tropical Agriculture, was appointed by Government to take charge of the Bat Investigation Work and assumed his duties early in 1934.

6. There was one meeting of the Veterinary Surgeons Registration Board held during the year to deal with an application for registration which was not granted.

7. Owing to the hurricane which swept Cedros and the surrounding districts during the year the Permanent Exhibition Committee of the Agricultural Society decided to postpone holding an agricultural exhibition—in which livestock always forms a most important section—and to substitute prizes for holdings including live-stock, (peasants and small proprietors) in these badly damaged areas in order to encourage the people to take full advantage of Government assistance to put their cultivations back in order.

8. There were two meetings of the Animal Husbandry Committee of the Agricultural Society held during the year at which the registration of the Society's brands for use on cattle was discussed and decided upon. The pure bred Zebu cattle on the Caroni Sugar Estate, registered by the Society, were branded by this Division and the Director of Agriculture decided to have the cattle at the Government Farm registered early in 1934 in order to encourage other owners to do the same.

9. During the year paralytic rabies in livestock was proclaimed under the Diseases of Animals Ordinance and two areas were immediately declared affected in order to carry out vaccination of live-stock against the disease.

10. The Government Veterinary Surgeon attended all the meetings of the Board of Agriculture during the year and submitted reports on paralytic rabies for the Board's information.

Proclaimed Diseases.

11. *Anthrax.*—There were no outbreaks of this disease during the year: three specimens were received from suspected cases but they all proved negtive. 18 head of cattle were vaccinated at the Quarantine Station during the year against this disease.

12. *Foot and Mouth Disease.*—Four British Alpine Goats (two bucks, 1 doe and a goatling) were imported from England during the year. Three of these animals passed through the Quarantine Station at the Port of London, but a special permit was granted to import the fourth animal which was quarantined at the owner's residence after its arrival in the colony for a month. 48 steamers arriving from South America (Argentine, Uruguay and Brazil) during the year were visited in order to inspect the certificates accompanying the frozen meat imported from these countries and to see that they were in accordance with the regulations under the Diseases of Animals Ordinance.

13. *Swine Fever.*—There were no outbreaks of this disease during the year.

14. *Tuberculosis.*—Sixteen head of cattle were detained at the Port of Entry for testing with Tuberculin but there were no reactors. In order to meet the requirements of the City Council in granting licences to milk vendors for the sale of milk in Port-of-Spain 1,100 dairy cows and heifers in rural district were tuberculin tested and of these there were two reactors. The reactors were destroyed and the owners compensated. Two cases were reported in the City Abattoir from local cattle and three cases from cattle imported from British Guiana for slaughter.

15. *Glanders and Epizootic Lymphangitis.*—No cases occurred—two cases of Ulcerative Lymphangitis were confused with both these conditions.

16. *Rabies.*—Twenty four dogs (15 U.S.A., 3 Bermuda, 2 France, 1 Colon, 1 Venezuela, 1 British Guiana, 1 Dutch Guiana) were imported from countries other than Great Britain and Ireland during the year and were quarantined for three months at the Government Station and for three months longer at their owners' residences, where proper arrangements had been made for this purpose. Two dogs died during the year from paralytic rabies in districts where the disease was prevalent among livestock.

17. Two domestic cats and one tiger cat were also quarantined during the year.

18. *Paralytic Rabies.*—This disease was again responsible for heavy death rate in livestock and over 90 per cent. of the cases occurred in cattle. The condition has now entirely disappeared from the southern part of the Colony and was only seen in the counties of Caroni and St. George East: Cunupia, Arouca and Dabadie were the districts chiefly affected. The incidence on the whole was lower than last year—308 cases reported—in spite of the heavy rainfall. As in former years the disease was most prevalent in the rainy season. On the recommendation of the Committee appointed to deal with the disease, vaccination was carried out on a more extensive scale and 15,709 animals were vaccinated during the year as compared with 6,000 in 1932. It was demonstrated during the year that the virus was present in the saliva of both human beings and animals suffering from the disease and the Government Pathologist also demonstrated that vaccination with the fixed virus of rabies in bovines protected against this virus. The vaccine again employed was a carbolised one containing 33 1/3 per cent. brain emulsion and it is giving satisfactory results. It has been found advisable to vaccinate within a wide range of affected districts and so to work ahead of the disease. The peasants' animals were again inoculated free of any cost but large proprietors were called upon to pay one shilling per dose for vaccine, the work being done by this Division without any charge. The following is a summary of the Interim Report of Dr. W. H. Andrews on the work undertaken at the Ministry of Agriculture's Veterinary Laboratory with the material from affected animals received from Trinidad :—

(i) Both naturally affected cattle and inoculated rabbits may show negri bodies, and also the ganglionic lesions of van Gehuchten and Nelis, apparently identical with those seen in rabies.

(ii) The symptoms shown by inoculated rabbits and guinea pigs are indistinguishable from those of ordinary rabies.

(iii) Guinea pigs are considerably more susceptible, or more regularly susceptible, to the Trinidad virus than rabbits.

(iv) In both rabbits and guinea pigs subcutaneous inoculations into the cheek is an effective method of transmitting the disease. In the rabbit it appears to be quite as effective as subdural inoculation.

(v) After nine and ten serial passages in laboratory animals the virus is capable of setting up fatal disease in cattle and sheep, with symptoms closely resembling or identical with those described in naturally occurring cases in Trinidad.

"Work which was contemplated in future at Weybridge included researches into conditions for the survival of the virus, and its resistance to destructive agents, distribution of the virus in the body, and the infectivity of blood, milk, saliva and urine, methods of transmitting the infection other than inoculation, susceptibility of other animal species, and the preparation of an effective vaccine and comparative tests of vaccine prepared from the Trinidad virus and ordinary rabies virus respectively."

Non-Proclaimed Diseases.

19. *Bovine Piroplasmosis.*—There was an outbreak of this disease in one of the dairies in Port-of-Spain The cattle had been reared in a paved yard and had never been naturally immunized as calves. Cut fodder containing seed ticks, from infected pasture land was fed to the animals and all the animals became infected with piroplasmosis; about 60 per cent. of the cows died. Trypan blue was used intravenously but in most cases the disease was already in a well advanced stage.

20. *Contagious Abortion in Cattle.*—Fewer cases were reported. In the large dairies where cases are mostly seen the segregation of all aborting cows for 60 days and the stabling of all cows in a maternity ward for six weeks before calving and three weeks more after calving, is giving satisfactory results.

21. *Parasitic Gastritis and Pneumonia.*—Owing to the extremely wet weather, cases were more frequently seen in sheep and cattle during the year. On one of the large sugar estates there was a heavy death rate in water buffalo calves. The condition cleared up when Copper Sulphate treatment was used and better arrangements made for housing the calves.

22. *Pneumonia in Calves.*—This condition which was causing considerable trouble in pure bred and high grade hand reared Friesian calves in the larger dairies, has been controlled by the use of wooden lathed flooring in pens, as reported last year.

23. *Ulcerative Lymphangitis.*—With the heavy rainfall and abundant mud, a few more cases were seen during the year, especially in heavy mules working in sugar cane districts: the disease is not seen as a rule in animals working in towns or large villages.

24. *Tetanus.*—No increase in the incidence of this disease: owing to the nervous symptoms two cases were confused with paralytic rabies.

25. *Dermatitis in Horses.*—A common condition seen in horsekind turned out to pasture during the heavy rains was a form of dermatitis on the hind quarters; even if horses were only pastured for a few hours during the day the quarters became affected. Animals responded to treatment as soon as they were removed from the pasture and a sulphur liniment or ointment applied to the quarters. A similar condition was seen in another very wet year (1927).

26. *Strangles and Influenza.*—Mules introduced on the sugar estates from the U.S.A. were responsible for an outbreak of strangles which was of a very virulent nature, there was in nearly every case a tendency to metastasis and abscesses were seen at the entrance to the chest, beneath the skin on the trunk and abdomen and in some cases around the mamary gland, besides the usual sub-maxillary and pharyngea lesions.

27. *Granular Sores in Donkeys.*—This condition is seldom seen in its chronic form: peasants treat wounds on their donkeys much more satisfactorily and so check the formation of these granulating sores on the legs of donkeys.

Importation of Animals.

28. The following animals were imported into the Colony during the year and inspected :—

Cattle	7,539
Horses	85
Mules	214
Donkeys	64
Dogs	57
Pigs	3,866
Sheep	1,392
Goats	4,297
Domestic cats	3
Deer	2
Lions	4
Tiger	1
Puma	1

Quarantine Station.

29. The following animals were admitted to the Quarantine Station during the year :—

Cattle	7,274 (including 348 from British Guiana
Horses	1
Mules	43
Donkeys	1
Pigs	438
Sheep	17
Goats	69
Dogs	24
Cats	3

The following deaths occurred at the Station: seven oxen died—four were trampled during landing, two from exhaustion and collapse and one from Septicaemia—and one pig, death due to trampling. It was necessary to slaughter immediately on their admission three oxen suffering from injuries.

30. The Revenue received by Government for the services of the Government Veterinary Surgeon for inspection of animals and for the supervision of the Quarantine Station amounted to £1,498 7s. 6d.

31. Owing to rabies vaccination campaign, it was necessary for extra expenditure to be allocated as follows :—

£	s.	d.	
500	0	0	preparation of rabies vaccine.
145	16	8	allowance for assistance.
645	16	8	

The amount collected for the sale of the vaccine amounted to £270 16s. 8d.

H. V. M. METIVIER,
Government Veterinary Surgeon.

REPORT OF THE MANAGER, ST. AUGUSTINE NURSERY.

Plant Distribution.

Plants distributed in 1933 were 92,719 as compared with 96,052 in 1932.

2. Revenue for all plants and other products was £1,374 17s. 0½d. as compared with £1,203 12s. 4d. in 1932, an increase of £171 4s. 8½d. The latter was due to a greater output of budded and grafted fruit trees for which the demand has increased annually for some years past, *see* table below :—

1924	7,522
1925	6,410
1926	7,138
1927	8,107
1928	10,040
1929	6,781
1930	8,001
1931	8,148
1932	15,837
1933	30,173

3. A detailed list of plants, seeds, cuttings, &c., distributed is given below :—

FRUIT, BUDDED AND GRAFTED :			
Grapefruit (Marsh)	20,934		
Grapefruit (Assorted)	2,115	23,049	
Oranges		3,313	
T. 1 limes		1,204	
Mangoes		1,332	
Avocados		1,275	30,173
CACAO :			
Seedlings		18,290	
Budded		84	18,374
LIMES :			
Seedlings, West Indian			34,278
MISCELLANEOUS FRUITS			1,107
TIMBER TREES			1,395
OTHER ECONOMIC PLANTS			559
DECORATIVE PLANTS			6,833
Total No. of plants distributed			92,719
BUDWOOD (No. of buds)			26,418
CUTTINGS			100
SEEDS :			
Countable			41,096
Miscellaneous	110 pkts. and 128 lb.		
FRUITS	377 and 7,089 lb.		
PREPARED TAPE			1,597 yds.

4. The demand for grapefruit plants being greater than the supply orders were executed *pro rata*, the number distributed being 23,049 as against 13,428 in 1932.

5. *Sour Stock.*—A sum of £1,562 having been promised for 1934 for the purpose of raising 30,000 additional grapefruit plants preliminary nursery work in connection with same was started and it is hoped that some of this number may be ready for delivery in 1934.

6. Approximately eight acres were planted with sour orange seedlings, an area estimated to give 80,000 plants. Scab (*Cladosporium citri*) was very severe and caused such a severe set-back to the plants that many were ruined. In the late planted fields, particularly, scab attacked the seedlings as soon as they were planted out, and infection occurred with each flush of growth.

7. The best method which appears to suit the conditions at St. Augustine is to sow seeds thinly in well prepared seed beds under shade, during January and February, and to transplant early in June. This method gives large plants which will withstand the attack of scab which would seem to be at its worst in September, October and November.

8. *Limes.*—Limes were in great demand, 34,278 being distributed as against 29,414 in 1932. Most of these were supplied from beds as " bare roots " plants, a method now favoured by planters.

9. *Cocoa.*—Only 18,290 young plants were sold, 12,000 being reserved in case of enquiries fo the areas affected by the hurricane; none of these were, however, required. This compares with 37,672 distributed in 1932, a decrease of 19,382 for the year.

10. *Mangoes.*—The demand continues for grafted varieties and 1,332 were sold in 1933 as against 1,123 in 1932, an increase of 209.

11. *Avocados.*—Enquiries for budded varieties continue to extend, 1,275 being distributed in 1933 as compared with 743 in 1932, an increase of 532 plants.

12. *Citrus.*—Budded plants of grapefruit, orange and lime are most in demand and increase yearly ; in 1932 14,971 were distributed as against 27,566 in 1933, an increase of 12,595.

Orchard Plots planted for propagating material in 1931.

13. *Avocados.*—The varieties " Pollock," " Rudder " and " St. Ann's " have fruited, budwood being taken from these when required. The following varieties have been added to this plot :—2 " Butler," 1 " Dunedin," 2 " Collinson," 1 " Winlowson," and 1 " Simmonds," budwood of which were presented by Dr. Fairchild in 1932.

14. *Mangoes.*—The following varieties have fruited this year :— "Zabricot," " Graham," " Roseau" " Sandersha," " Divine," " Gordon," " St. Lucia Pere Louis," and " Minnie." These are now being used for grafting.

15. *Citrus.*—Varieties of oranges which fruited this year are as follows :—" Parson Brown," "Valencia," " Lue Gim Gong," " St. Michael," " St. Michael's Blood," " Majorca," " Pineapple, " Lamb's Summer," " Sandford's Mediterranean," " Ruby," " Homosassa," " King," " Cleopatra." Comparisons are being made to ensure the varieties are true to name.

16. The following species introduced from Washington in 1929 are now flowering and fruiting :— *Atalantia citroides, Atalantia disticha, Aeglopsis chevalieri, Glycosmis pentaphylla, Severinia buxifolia.* Two Cocoa oranges, 1 Navel Marsh grapefruit, 1 Seville orange, 1 Perrine lemon and 1 Villa Franca lemon have been added to this plot.

General.

17. *Tung Oil.*—Trees of *Aleurites montana* flowered in the months of May, June, July, September male flowers only. On the southern portion of the Citrus Experiment Station 50 additional plants have been established. *Aleurites fordii* have all died.

18. *Tonca Bean.*—Trials were made with the budding of Tonca bean (*Dipteryx odorata*). Seeds sown in open beds in May, 1932, were budded on in 27th January, 1933, by both patch and inverted methods. Of 18 plants budded by the patch method two only were successful; 15 budded by the inverted method, all failed.

19. *Clove.*—The raising of seedlings has in the past been unsuccessful owing to fungi infection on leaves and stems when the seedlings were only a few inches high. This has now been found possible by sowing seeds in shaded beds where the plants grow healthy and strong. They are allowed to remain in the beds until large enough for distribution, being then lifted and placed in bamboo pots or the pillon wrapped in sacking.

20. Thirty trees have been planted in a plot south of the Citrus Experiment Station for seed purposes.

21. *Ginger.*—Collections of ginger from Barbados, Jamaica, Dominica and Grenada are being grown in small plots for comparison with that grown in Trinidad and Tobago.

22. *Melon.*—Trials of 16 varieties of Musk and Water Melons were made, most of these became infested with a caterpillar in the stem of the plant and fruits. The only one that showed promise was the "Rattlesnake" water melon, and as a means of encouraging this variety in districts where the local varieties are grown, seeds were distributed in February to the Agricultural Advisers of Siparia, San Fernando and Tobago, also to Messrs. Rapsey and Llanos.

23. *Cauliflower.*—The following Cauliflower varieties were imported from Calcutta through Messrs. Sutton & Sons for trial:—"Maincrop Benares," "Early Benares," "Maincrop Patna," "Early Patna."

24. "Early Benares" and "Early Patna" were the most successful, "Early Patna" giving 120 heads from 129 plants; a large proportion in the other varieties did not head.

25. *Sunflower.*—Seeds of "Russian Sunflower" were sown under glass in clay pots during the first week in March; germination was good. Towards the end of March 100 plants were transplanted 2 ft. 6 ins apart in a plot in the trial ground and one row was sown at stake on the side of the plot.

26. Cutting of the ripe heads commenced in the middle of June and completed in July, 100 being sent to St. Clair. Those sown at stake did not grow large enough to produce flowers.

27. An examination of the pods gave the following results:—diameter, 4 ins. to 11 ins.; weight of head 1 lb. to 2¾ lb.; weight of seed varying from ½ oz. to 4 ozs. per head.

28. A larger plot has been sown in a field on the Experiment Station.

29. *Oil Palm.*—A consignment of 825 seeds of *Elaeis guineensis* was received with instructions to soak half the quantity in a solution of one part commercial H.C.L. to thirty parts of water by volume for two days, and the remainder to be untreated. Those soaked in the acid solution were afterwards washed in running water for a further two days before sowing.

30. Of those treated with acid 18 per cent. germinated as compared with 23 per cent. of the untreated. Poor germination on the whole may have been due to the seeds being stale on arrival from Nigeria. The seedlings have been planted in beds in the trial grounds for distribution later.

31. *Maize.*—The following introduced varieties have been grown and seeds collected for further trials:—"Whatley," "Garrick," "Mosley," "Cockie," "Grenada" and "Six Weeks."

32. *Papaw.*—Trial plots were laid out with the following varieties from Porto Rico, Mexico and Seychelles:—

"Porto Rico"—a variety with round medium sized fruits.

"Mexico"—a variety with long, large fruits.

"Seychelles"—a variety with small oval shaped fruits, small seed cavity and fine flavour.

33. The trees were all short and fruited heavily. Further trials from seeds saved from the different varieties will be continued.

Donors:—

Abroad.—Departments of Agriculture, Nigeria, Basutoland, Jamaica, Cuba, Grenada, United States of America. Professor Juan Balme, Mexico; Dr. Fairchild, United States of America; Mr. P. C. Rhenock, India; The Director, Imperial Institute, London; Messrs. Vilmorin-Andrieux, Paris; and Miss Sealy, Barbados.

Local.—Imperial College of Tropical Agriculture and Dr. Wise.

Chief Plant Introductions.

Bananas.—Burma and Ananica from the Imperial College of Tropical Agriculture.

Oranges.—Pineapple from the United States of America.

Sugar Cane.—Mayaguez 28, from the United States of America.

Lima Beans.—Madagascar and Danubin from the Imperial Institute; Madagascar and Ohtenashi from Burma.

All have been successfully propagated.

34. *Solar Propagators.*—A special vote of £100 was granted for erecting two complete ranges of 12 compartments each for the vegetative propagation of cocoa from selected trees at River Estate.

35. *Educational.*—Second and third year students of the Tranquility Training College attended regularly for practical work on school gardening.

36. The following persons attended for instructions:—Messrs. A. Peterkin, E. Gibbs, W. O. B. Donovan and de Verteuil.

37. Visits were paid by the Closer Union Commission, troops of Boy Scouts from Demerara and Grenada, and pupils from St. Ann's R.C., St. Joseph E.C., Moruga E.C. and Tunapuna E.C. Schools.

38. The annual visit of the Principal, Professors and Students of the Imperial College of Tropical Agriculture was made in November.

39. *Trials.*—An experimental shipment of citrus budwood of the following varieties, was made:—Marsh and Foster grapefruit, Valencia, Parson Brown and Lue Gim Gong oranges. The budsticks were packed in thermos flasks and sent to Nigeria *via* Liverpool in a cool room. The following report on the condition of the budwood on arrival was received:—

100 *Marsh Grapefruit.*—All the budwood had turned brown and soft. No viable buds were obtained.

100 *Foster Grapefruit.*—All in excellent condition yielding 92 buds.

100 *Valencia Orange.*—A few stocks had become mouldy, quite distinct from the brown rot of the Marsh grapefruit, 65 buds obtained.

100 *Parson Brown Oranges.*—In the same condition as the Marsh. No viable buds.

50 *Lue Gim Gong Orange.*—In excellent condition yielding 50 buds.

40. It will be seen, therefore, that the method of despatching budwood over long distances in thermos flasks appears practicable.

41. Further trials are being made in 1934 and special care will be taken in the selection of the budwood of those varieties that failed to grow.

42. *Weather.*—Rains were more or less continuous throughout the year; there was no dry period of long duration as in the case of normal seasons.

43. The St. Joseph River which is on our western boundary, overflowed its banks on the afternoon of the 1st August and flooded the nursery compound to a depth of several inches. It was the highest flood known for the past ten years.

F. C. BUTHN,
Manager of Nursery.

12th June, 1934.

REPORT OF THE MANAGER, ST. AUGUSTINE EXPERIMENT STATION.

Citrus Experiments.

The citrus experimental plots cover an area of nearly 45 acres and are conducted in accordance with a 1931 programme. The latter comprises manurial and cultivation trials, and investigations as regards stocks, and methods of propagation in relation to gummosis.

2. Routine work during the year was carried out according to plan.

3. The half-yearly census and measurements of all trees in the experimental area was undertaken between February 7th and March 10th, also June 19th and July 15th. Measurements of height, spread and diameter of trunk were taken, and the attacks of pests and diseases noted.

4. The trees in the manurial experiment were given the prescribed quantities of manures in January, May and August. The January manuring was applied soon after planting was completed, to give the trees a good start. Normally May and August are the only times of application. All the trees in other experiments were manured according to plan in May, August and October.

5. Trimming was carried out in August on all trees which needed shaping.

6. Routine work of weeding, forking, &c., was carried out.

7. The chief pests were scale insects during the dry season and stinging ants during the wet season, both of which caused a certain amount of trouble. They were successfully controlled by spraying with Citro-Mulsion. All trees were examined once a week and any tree which needed it, was sprayed.

8. Two trees were stolen, two destroyed and five damaged by persons unknown.

9. Several plots had to be supplied with new trees, owing to the failure of those originally planted. Twelve trees were supplied to experimental plots and 14 to guard rows.

10. The planting up of several plots was completed during the year, with trees which were not previously available.

11. Experiment 7—Stocks for Oranges—was completed by planting the Pineapple variety section.

12. In Experiment VII (Stocks for Oranges) 16 trees, and in Experiment II (Comparison of Stocks) four trees have still to be planted.

13. Several trees produced fruit during the year. In Experiment I (Stocks for Grapefruit) three trees gave a total of nine fruits and in Experiment II, ten trees 27 fruits.

Cassava.

14. The following varieties are being grown and kept for stock :—
Bitter Cassava.—Sellier, Parasol, Turkey Claw, Mama l'enfant.
Sweet Cassava.—White Stick, Black Stick.

Sugar Cane.

15. The area under sugar cane was still further reduced owing to the cane breeding work now being centralized in Barbados. There is at present 18.38 acres of land available for sugar cane and other crop trials.

16. The crop was reaped during the period March 28th to May 3rd, and yielded 431.91 tons for 26.13 acres, an average of 16.73 tons per acre. The canes were sent to Orange Grove factory.

Sugar Cane Crop, 1933.

Age of Canes.	*Acreage.*	*Yield.* Tons.	Cwt.	Qr.	*Tons per acre.*
Plants	6.41	159	12	1	24.53
1st Ratoons	9.57	161	2	0	16.77
2nd do	9.58	90	4	0	16.07
3rd do.	4.57	20	11	0	4.45
Total	26.13	431	9	1	16.73

Variety Trials on Sugar Cane Estates.

17. Nine variety trials were reaped on six estates, between February 20th and June 1st. Each trial was divided into three parts, each part being reaped at a different time, with an interval of one month between each reaping.

18. The full results of these trials are published separately during the year in a Bulletin of the Department.

Visitors.

19. The Students of the Imperial College of Tropical Agriculture accompanied by Professor R. C. Wood and several members of the staff visited the station during November. A demonstration of rubber tapping and a brief explanation of the experimental work of the station was given.

Rainfall.

20. The figures taken from the rain gauge at the adjoining Government Farm show that 88.47 inches fell during the year.

Old Citrus Plots.

21. The following table shows the total amount of fruit harvested from the orange and grapefruit trees :

Yields—Average Number of Fruit per Tree.

Grapefruit.				Oranges.		
Marsh.	Foster.	Walters.	Duncan.	Jaffa.	Parson Brown.	Valencia.
781	673	525	601	375	631	359

Revenue and Expenditure.

22. The total Revenue amounted to £379 4s. 8d. and the total Expenditure to £2,245 8s. 3d.

E. J. GREGORY,
Manager,
St. Augustine Experiment Station.

13th June, 1934.

REPORT OF CURATOR BOTANIC GARDENS.

Royal Botanic Gardens, Government House, St. Clair, Queen's Park, St. Anns' Mendez Savannahs and Red House.

The Gardens throughout the year were well maintained and considerable improvements were made, by removal of over-crowded sections, and opening out of vistas so as to enlarge the views and emphasize the effective sweep of the lawns.

2. New areas were taken under control and grass developed wherever possible with mowing machines. Grass edges have been straightened and iron pegs placed for permanent lining out, when trimming is necessary. Many paths have been regravelled and the general appearance of the pathways is somewhat improved.

3. One hundred and twenty-nine Spelter Garden labels were cleaned and lettering reblackened 39 Garden labels were imported and placed out ; 1,000 special cedar wood labels were purchased locally for naming temporary bedding plants. Ruskilla paint was found useful for repainting the garden benches.

4. Displays of annuals were well represented during the year and the following bedding plants withstood the very abnormal season during the wet weather. Sulphur yellow, orange yellow and the chrome yellow varieties of Marigolds (*Tagetes erecta*), gave a pleasing splash of colour. Many varieties of *Zinnia elegans* planted in beds, each of a separate colour, were very satisfactory, especially the Liliput Pompom varieties.

5. During the drier periods the following were tested and proved successful : *Phlox Drummondii* varieties, *Celosia plumosa, Calendula officinalis, Petunia hybrids, Callistephus hortensis,* and *chinensis* varieties, *Candytuft* and *Carnation* (*Dianthus*). Of the new introductions useful for bedding out were the following : *Arctotis grandis, Cuphea platycentra* and *C. lanceolata purpurea, Rehmannia angulata.*

6. For permanent and long flowering subjects the following plants gave very showy results : *Helianthus agrophyllus* (silver leaved Sunflower), *Heliotropium peruvianum, Cuphea micropetala, Gaillardia perennis, Solidago canadensis, Coreopsis tinctoria, Ipomoea fistulosa, Russellia equisitiformis, Pseuderanthemum seticalyx, Pentas carnea, Pentas coccinea, Canna* varieties, *Clerodendron fallax, Daedalacanthus nervosus, Plumbago capensis.*

7. An experiment with *Euphorbia pulcherrima* (Poinsettia), single red and white, as a bedding plant proved successful. A brilliant splash of colour was made with two beds flowering well during Xmas time. Cuttings were propagated direct in bamboo pots during May. These were transplanted to their permanent positions in August ; the young growths were pinched back once, producing low floriferous plants. Two beds of *Caesalpinia pulcherrima* seedlings were similarly treated after being cut back when one foot high and produced abundant blooms.

8. A special effort was made during the year to enlarge the orchid collection and a number of native and introduced species were obtained from various sources ; especially from donors in exchange for seeds and plants.

9. The Botanic Gardens exhibited an extensive collection of plants and cut flowers at the Horticultural Flower Show held at the Princes Building on the 7th and 8th April. This exhibit was much appreciated by the members of the Horticultural Club and the general public and the hope was expressed that similar displays would be a regular feature at future shows.

Government House Gardens.

10. The gardens surrounding His Excellency's residence have been well maintained and many useful annuals were planted throughout the year, especially for cutting purposes for decorative work.

11. Pleasing displays of flowers in the " Lady Chancellor Garden " and in " Lady Byatt's ", were noticeable nearly all the year.

12. Three hundred rhizomes of *Gloriosa superba* were planted in a new border. Eighty *Anthuriums* (*Andreanum* varieties) were established for cutting purposes.

13. A portion of the area near the Guard House has been added to Government House grounds, and an *Acalypha* hedge has been established along the public path.

Vegetable Garden.

14. Many vegetables of all kinds were grown in the garden and the Early Patna cauliflower proved extremely successful during nine months of the year.

St. Clair Office.

15. Attention to this area has been given regularly, and the surroundings of the buildings kept tidy.

Savannahs.

16. General quarterly inspections were made during the year and an extensive number of trees were planted in the Queen's Park Savannah ; flowering trees were selected for the purpose in order to give more colour in the Savannah. One hundred and forty-five trees were planted.

17. Attention has been paid to the following Government lands—Red House, Mucurapo Pasture, Audit Office, Queen's Royal College, Government Printing Office, St. Ann's Asylum and the Colonial Hospital.

18. I have to acknowledge many donations from abroad and from local sources. Chief among those to whom the Department is indebted are :—

Abroad :—

The Coconut Grove Arboretum.
F. G. Walsingham, Esq., Botanic Gardens, Cuba.
The Department of Agriculture, U.S.A.
Messrs. Vilmorin, Andrieux & Cie., France.
Lady Muriel Jex-Blake, Kenya.
O. Tate, Esq., Venezuela.
J. E. Higgins, Esq., Panama Canal Zone.
Botanic Gardens, Georgetown, B.G.
H. Q. Levy, Esq., Brown's Town, Jamaica.
Bernado Navarro, Honda, Columbia.

Local :—

Captain Johnston.
Mrs. A. Wight, Trinidad.
Mrs. Radcliffe-Clarke.
Miss E. Arrindell.
W. E. Broadway, Esq.
The Forestry Department.

19. Many new annuals have proved successful in the Botanic Gardens, and a pamphlet dealing with the more successful introductions will be published later.

H. BRUINS-LICH,
Curator.

REPORT OF THE MANAGER, RIVER ESTATE.

Honourable Director of Agriculture :

I beg to submit herewith my report on the working of River Estate for the year 1933.

Although not as wet a year as its predecessor the rainfall during 1933 was above the average and there was a complete absence of the usual "Indian Summer." The total rainfall registered was 74.04 inches as against 87.01 inches during 1932. It is interesting to note that despite the last two years of exceptionally wet weather River Estate was fortunate in escaping the heavy precipitations and resulting floods which so materially damaged the lower portions of the Diego Martin Valley and the neighbouring valleys of Maraval, St. Ann's and Santa Cruz. In this respect it may be noted that the surroundiug hillsides of these valleys are being rapidly denuded of their natural vegetation by continuous clearing and firing for provisions growing and as a consequence they remain unprotected from the unfavourable influences of wind and rain, whereas, the timber cultivations at River Estate are gradually assuming natural forest conditions and may possibly play some part in prevention of erosion and the more even distribution of rain around the plantations as a whole.

Early in the year there was a complete re-organization of the system of accounting and with the appointment in March of Mr. C. D. Hatt, as clerk, a long felt want has been supplied. This has led to a general tightening up of clerical and administrative work by permitting the several members of the staff to confine themselves to their specific duties.

Revenue and Expenditure.

The total revenue for the year amounted to £2,544 13s. 2d. and the total expenditure to £5,195 10s. 10d. Revenue from cocoa which is our main product has continued rapidly on the downward trend for the past five years and as an instance of the price factor on a main commodity a comparison of revenue for the years 1925 and 1933 is interesting. In 1925 a more or less similar crop of 1,169 bags realized a sum of £4,654 12s. 9d. whereas the 1933 crop of 1,164 bags was worth only £1,959 8s. 2½d. Revenue for 1933 is the lowest recorded for the past twenty years. Although the total income for the year was so deplorably low the fact that a sum of £563 9s. 6½d. was obtained from produce other than cocoa marks the definite coming into production of subsidiary crops which should within the next few years fully justify the expenditure incurred on their development. It is anticipated that revenue from these crops will be in the vicinity of £750 during the current year and will continue to increase from year to year as development proceeds.

The expenditure mentioned above includes the sum of £1,562 14s. 11½d. spent on timber cultivation, crops other than cocoa, non-recurrent expenditure, experimental work and the purchase of a new motor lorry and working mule.

The cocoa crop amounted to 1,164.04 bags of 165 lb. each and though lower than the previous year's crop of 1,325 bags may be regarded as satisfactory as it brings the previous five years average from 1,064 to 1,198 bags despite the fact that during the latter and earlier parts of 1932 and 1933 respectively some 20 acres of bearing cocoa were cut out for new plantings. All cocoa was as usual dealt with by the Cocoa Planters' Association. The price paid touched a new low record and averaged only 4¼ cents per lb. for first-grade produce. In the 1932 Report mention was made of the low percentage of black cocoa obtained and it is satisfactory to be again able to report that in spite of the abnormally wet weather during the past two years there has been a still further decrease in the incidence of pod-rot during 1933, the percentage of black cocoa and pasilla working out at only 1.3 per cent. That the quick burial of shells after reaping is effective as a control measure seems to leave little room for doubt. The cocoa cultivation was given the usual attention, particular care being given to young cocoa supplies of which a large number have been planted out during the last two years. Trenching with pen manure of fields Nos. 6A and 6B was started and completed as also the trenching without pen manure of the rest of field No. 11. Trenching without pen manure of fields Nos. 1A and 1B which were started in 1931 and 1932 respectively was also completed.

The new road laid down last year between field No. 22 and the citrus cultivation was completed together with the necessary concrete culverts and all roads throughout the estate have been numbered, measured and labelled accordingly. Considerable damage was caused by Thrips to certain parts of the cultivation during the latter part of 1932 and the first two months of 1933 but fortunately there was not the usual recurrence of these at the end of the year under review and in consequence the cocoa trees have maintained a fairly good canopy. Cocoa beetles were plentiful during the drier months and caused a fair amount of damage, particularly to young trees in exposed areas. Rosellinia root disease was not more troublesome than usual to cocoa but is fast taking toll of the hibiscus hedges and it has been necessary to dig up much of the hibiscus and substitute Robusta coffee along the hedge rows. Witchbroom disease which made its appearance in October, 1932 is spreading very slowly but surely. During the year 608 brooms were cut out and destroyed and every effort is made to remove and destroy these brooms before the fungus spores develop.

Grapefruit and Oranges.

The cultivation of this section has been considerably improved. More than half of the whole area, comprising 30 acres, was hoe-weeded and manured with both pen manure and Ammo-phos. The latter at the rate of 2½ lb. per tree, while careful attention was given to pruning, treatment of diseases, draining roundridging and filling of depressions. The trees have responded nicely to this treatment and it is anticipated that the grapefruit and orange crops from 1st July last to 30th June next will reach 1,200 and 600 cases, respectively. The previous crop was, however, extremely disappointing both as regards quantity and price: 148.25 cases grapefruit and 294 cases of oranges delivered to the Citrus Growers Association to 30th June, 1933, realized between them only £77 16s. 5d. It is unfortunate as regards grapefruit to have to report that gummosis disease, by which term is included foot-rot, is steadily becoming so serious a matter as to be almost inevitable. Indications would point to the fact that the cause of this trouble is primarily due to a lack of harmonizing affinity between the grapefruit and sour orange plants as scion and stock. Careful observation points to a distinct correlation between proximity and remoteness of relationship of scion and stock and incidence of the disease in question. This is a matter that should receive very careful consideration and investigation in view of the apparently strong tendency to increase still further along present day prescribed methods the comparatively large areas under grapefruit cultivation within the colony. While the application of oil or mortar soil seals around the trees—an experiment which has formed the subject of a separate paper—will serve as an effectual control measure it cannot be claimed as a means of prevention. One thousand one hundred and forty-eight feet of new road with the necessary concrete bridges and culverts was also completed in this section and greatly facilitates the transport of manure and produce.

Mangoes.

The Julie mango field was kept in good order but for the third consecutive year failed to produce a crop.

Limes.

The lime crop was fair and amounted to 572 barrels of 160 lb. each. Of this amount 380 barrels were sold to Mr. F. E. Gransaull at the rate of $2.00 per barrel, 73 barrels were sent to the Citrus Growers Association for shipment as green limes and 116 barrels were sold on the spot to hucksters. The total revenue from limes amounted to £232 14s. 9½d. The area in young and bearing lime trees is approximately 20 acres and roughly another 20 to 25 acres are in the hands of contractors.

Tonca Beans.

In view of the favourable price ruling for some years the tonca bean plots have been given extra attention and are developing well. Several new areas are being planted up by contractors and a two-acre block of layered plants has been started. Revenue from this source amounted to £63 3s. 8d.

Coffee.

The Robusta coffee interplanted in fields 14, 15 and 16 produced its record crop of 4,530 lb. which realized £85 4s. 1d.

Timber.

There has been considerable improvement to this large area which covers some four to five hundred acres and through which some 5½ miles of bridle roads have been contsructed. About three-fourths of the whole plantation was gone through by gangs for the purpose of thinning, pruning and clearing. Some of the thinnings from the more accessible areas were sold as firewood and posts and realized a sum of £18 1s. 8d. During the year 14 more contracts containing 7,065 trees were taken over thus bringing the total number of trees already paid for to approximately 62,000. This branch of development at River Estate though little realized by Government or the general public is fast assuming proportions of great potential value and bids fair in the not far distant future to become a source of considerable revenue to Government.

Experimental Work.

This work has been greatly increased of late years and entails the keeping of individual records and characteristics of some 17,000 cocoa trees. The planting of the new 12-acre block in Field No. 19 from seed of six special trees has been completed and is progressing well. Much work in collaboration with officers of the Imperial College of Tropical Agriculture is also being carried on. Experimental work the Department comes under the control of the Agronomist and is dealt with in detail by him in a separate report.

Works and Buildings.

The galvanized roofing of some of the barrack rooms is bad and should be renewed. The buildings generally are in a fair state of repair but most of them require painting. A much needed improvement would be the oiling of the yard, particularly in the vicinity of the office and store rooms which are smothered with dust throughout the dry season and is a source of great discomfort to the clerical staff.

Stock.

The stock comprises 5 horses, 3 mules, 1 Holstein bull, 2 grade Holstein cows, 1 grade heifer and a bull calf born on 9th April. Of the five horses one is a very fine filly foal born on 2nd May. This animal is by "K.P." out of the mare "Patricia" by "Marat." The young bull calf mentioned above is a particularly fine specimen of the Holstein breed. The animals all kept good health during the year.

Visitors.

Visitors to the estate were fairly numerous during the year and there were field excursions by the Imperial College of Tropical Agriculture, the Forest Rangers' Association, the Diego Martin District Agricultural Society and the Field Naturalists' Club. The year was a very busy one and I wish to place on record my appreciation of the help I have at all times received from all members of the staff whose duties are continually increasing with the development of this large property.

The usual statements in connection with the report are attached.

RODERICK O'CONNOR,
Manager, River Estate.

RIVER ESTATE.

Statement of Revenue and Expenditure, 1933.

Revenue.	£	s.	d.	Expenditure.	£	s.	d.
Cacao	1,959	8	2½	62, 63 and 64. Personal Emoluments	1,021	13	10½
Miscellaneous	563	9	6½	65. Maintenance	2,713	3	5
Pasture fees	21	15	5	66. Transport and travelling	220	12	8½
				67. Incidentals	99	15	4
				68. Timber contracts	199	19	9½
				69. Improvements	349	17	3
				70. Fertilizers	25	0	0
				71. Materials	124	17	9
				72. Stock	163	19	5½
				73. Experiment on new varieties	100	0	0
				Special Head—New Lorry	176	11	3
	£ 2,544	13	2		£ 5,195	10	10

RIVER ESTATE.

Detailed Revenue for year ending 31st December, 1933.

Particulars.	£	s.	d.
By Sale of :			
Cacao (manufactured cocoa and pasilla)	1,959	8	2½
Limes	232	14	9½
Coffee	85	4	1
Grapefruit and Oranges	77	16	5
Tonca Beans	63	3	8
Pasture fees	21	15	5
Firewood and posts	18	1	8
Mangoes		19	6½
5,000 lb. Corn to Government Farm	15	12	6
Old Lorry	5	18	1
Miscellaneous (cocoa pods, provisions, &c.)	63	18	9½
	£2,544	13	2

RIVER ESTATE.

Abstract of Expenditure for the year ending 31st December, 1933.

Particulars.	$ c.	$ c.
STAFF :		
Manager	2,160 00	
Overseers, Drivers and watchman	2,962 18	
Manager's travelling allowance, Messengers, &c.	441 94	5,564 12
MAINTENANCE :		
Roads, Bridges, Hedges and Borders	426 34	
Water Service and River	19 19	
Repairs to buildings	267 81	
Supplies, Tools, Bags, &c.	571 80	
Yard and Sanitation	554 37	
Pasture	86 64	
Destruction of Vermin (Ants, Beetles, Squirrels, &c.)	110 00	
Sundries, including Visitors, Student, telephone and other public services	384 75	
Cocoa nurseries	12 05	2,432 95
TRANSPORT AND STOCK.		
Labour—Stock-keeper, grass-cutters, Maintenance grassfield, &c...	527 38	
Materials—Stock-feed, repairs, cart harness, shoeing, clipping &c.	560 71	
Produce—Motor Lorry (including gasolene, oil, repairs, chauffeur and attendant)	1,039 18	2,127 27
NON-RECURRENT " A " :		
New Roads, Bridges, Canals and Railway	637 25	
New Motor Lorry	847 50	
New Working Mule	175 00	
New Filing Cabinet with Stationery	150 42	1,810 17
NON-RECURRENT " B " :		
Clearing New Lands—including weeding cutlassing, and stumping	97 22	
Lining and planting—Tonca Beans, Coffee and Limes	127 97	
Purchase of Contracts (Cacao contracts)	118 28	343 47
CACAO CULTIVATION :		
Cutlassing, weeding and Stumping	2,142 64	
Trenching, Mulching and Manuring	824 07	
Pruning and Tarring	586 56	
Supplying Cacao and ground shade	250 58	
Draining	27 93	
Plant Sanitation : Digging of diseased trees, burying cacao shells, &c.	541 65	
Shade Control	67 08	
Witchbroom	99 02	4,539 53
MANUFACTURE :		
Reaping	2,128 46	
Curing and bagging	645 08	2,773 54
FRUIT :		
Cultivation—cutlassing, weeding, manuring, supplying, &c.	1,393 50	
Reaping	44 12	
Mango Cultivation—cutlassing, draining, &c.	51 64	1,489 26
COFFEE :		
Cultivation	91 76	
Reaping, drying and hulling	122 55	214 31
LIMES :		
Cultivation and maintenance of roads	223 30	
Reaping and Transport	250 26	
Advances to Contractors	43 00	516 56
TONCA BEANS :		
Cultivation—including layering, experiment and manuring	160 57	
Reaping	16 01	176 58
TIMBER :		
Cultivation—Cutlassing, clearing vines, thinning, maintenance roads	828 21	
Sawing and transport of timber	156 44	
Purchase of Contracts and advances	494 78	1,479 43
EXPERIMENTAL WORK :		
Supervision	436 80	
Labour—New Experiments	919 44	
Materials	115 17	1,471 41
		$24,938 60
		£5,195 10 10

RAINFALL FOR YEAR 1933.

Station No. 119.—River Estate, Diego Martin.

Day of Month.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Grand Total.
1 ..	.09	.15	—	.36	—	—	1.19	2.95	.16	—	.38	.48	
2 ..	.15	.09	—	—	—	.34	1.03	1.34	—	1.20	.06	.14	
3 ..	—	—	—	—	—	—	.03	.10	.46	—	.54	.98	
4 ..	.12	—	.06	.32	.04	1.03	.20	—	.70	.62	.81	.10	
5 ..	.25	—	—	.05	—	—	—	—	.16	—	—	.16	
6 ..	.30	.54	—	—	—	—	—	—	.20	—	—	—	
7 ..	.15	—	—	—	—	.06	—	1.38	—	—	—	.17	
8 ..	—	—	—	—	—	—	—	.36	—	—	.75	—	
9 ..	—	—	—	.60	.06	—	—	.09	.10	.50	.35	.09	
10 ..	—	—	—	—	—	—	—	.36	.60	—	—	.11	
11 ..	.36	—	—	—	.69	—	—	—	—	.15	.12	.75	
12 ..	.25	—	—	—	—	.35	1.35	1.50	—	.10	.18	2.40	
13 ..	.05	.10	.14	.06	—	.55	—	—	.10	.25	.09	.19	
14 ..	—	.14	.11	—	.62	1.14	—	.06	.54	.90	.30	—	
15 ..	—	.16	.18	—	.20	.27	—	.16	.12	1.28	.78	—	
16 ..	1.18	—	.24	—	—	.09	.10	1.50	.14	.22	—	—	
17 ..	—	—	.50	—	—	—	—	.15	1.40	.30	.06	.21	
18 ..	—	—	—	—	—	.26	.30	—	1.35	1.12	.20	—	
19 ..	—	.10	.10	—	.35	.09	.42	—	.20	.09	.23	.13	
20 ..	—	.21	.12	—	—	—	—	.50	.28	—	.20	.25	
21 ..	—	—	.08	—	—	.83	.12	—	.22	1.64	.14	—	
22 ..	.25	—	—	—	—	—	.09	.20	.09	—	.19	—	
23 ..	—	.06	.10	—	—	.04	—	—	—	.68	—	—	
24 ..	—	.30	—	—	—	.60	1.45	.14	—	—	—	.15	
25 ..	.04	.04	.37	—	.40	1.46	—	—	.40	.04	—	—	
26 ..	—	—	—	.20	.18	.30	—	.62	.20	—	.10	.12	
27 ..	.18	.08	—	—	—	.93	—	.04	—	.09	.21	—	
28 ..	—	—	—	—	.03	1.18	.33	.39	.09	—	—	—	
29 ..	—	—	—	—	—	—	1.00	1.08	—	.10	.33	—	
30 ..	.58	—	.15	—	—	.30	.34	—	.95	—	.39	—	
31 ..	.15	—	.04	—	—	—	.35	—	—	—	—	—	
	4.10	1.97	2.19	1.59	2.57	9.82	8.30	12.92	8.46	9.28	6.41	6.43	74.04

COUNTING AND CROP RETURNS.

Field No.		Bearing Trees	Half Trees.	Quarter Trees.	Supplies.	Dead or Missing.	Total Pickets.	Acreage.	Appr-Age.	No. of bags of 165 lb.	No. of bags per acre.	Remarks.
1	A ..	2,394	215	161	40	552	3,362	11.8	31-36	28.24	2.3	Part trenched without manure 1931-1932. Completed 1933.
	B ..	1,145	114	117	24	377	1,777	6.2	31-36	12.51	2.1	Part trenched without manure 1932. Completed 1933.
2	A ..	1,444	247	171	179	148	2,189	11.1	61-66	20.38	1.8	Experimental Field. Replacement of poor bearers.
	B ..	1,331	276	139	100	55	1,901	9.6	61-66	18.77	1.9	do. do.
3	A ..	1,824	361	141	196	129	2,651	13.3	61-66	33.43	2.5	Part trenched without manure part trenched with manure, and part treated with fertilizer, 1931.
	B ..	1,572	250	67	25	291	2,205	11.3	61-66	21.99	1.9	No special treatment.
4	A ..	1,725	139	35	—	779	2,678	9.0	51-61	6.61	.7	No special treatment
	B ..	2,014	70	56	—	876	3,016	10.0	51-61	21.63	2.1	do.
5	..	2,484	189	147	174	112	3,106	16.4	61-66	49.70	3.0	Shade and Fertilizer Experiments.
6	A ..	2,726	68	99	21	155	3,069	10.2	31-36	25.92	2.5	Trenched with manure, 1933.
	B	1,849	52	76	8	218	2,203	7.3	31-36	16.09	2.2	do. do.
	C ..	1,727	47	69	10	121	1,974	6.6	31-36	18.23	2.7	Trenched with manure, 1932
7	A ..	2,314	112	118	50	89	2,683	8.6	31-36	23.60	2.7	Trenched with manure 1925.
	B ..	2,074	81	91	10	62	2,318	7.5	31-36	27.35	3.6	do. do.
8	A ..	3,557	79	306	179	214	4,335	14.5	31-36	38.97	2.6	Trenched with manure, 1927.
	B ..	1,398	66	105	95	108	1,772	6.0	31-36	23.77	3.9	do. do.
	C ..	1,708	66	206	171	202	2,353	7.8	31-36	22.89	2.9	do. do.
9	A ..	1,839	119	158	74	115	2,305	7.8	31-36	23.24	2.9	Trenched with manure, 1928
	B ..	1,794	60	71	9	174	2,108	7.0	31-36	25.20	3.6	do. 1928-29
	C ..	2,461	129	138	249	137	3,114	10.4	31-36	27.00	2.5	do. 1929-30
10	A ..	1,574	87	73	585	—	2,319	7.5	31-36	19.66	2.6	Trenched with manure 1930-31
	B ..	2,034	107	103	533	—	2,777	9.2	31-36	23.95	2.6	do. do.
11	..	2,233	198	169	505	—	3,105	10.3	31-36	23.06	2.2	Part trenched with manure 1931 : Rest trenched without manure, 1933.
12	A ..	2,847	132	158	122	1,369	4,628	13.8	31-41	31.11	2.2	No special treatment.
	B ..	386	14	7	1	112	520	1.7	31-41	1.9	1.1	do.
13	A ..	2,371	105	141	185	673	3,475	14.0	31-41	55.78	3.9	No special treatment.
	B ..	1,573	96	82	1	215	1,967	7.8	31-41	39.33	5.0	Very good natural conditions.
14	..	982	56	27	1	617	1,683	6.1	61-66	7.50	1.2	Part interplanted with Robusta Coffee.
15	..	1,089	72	19	—	569	1,749	5.7	31-91	12.51	2.1	Part interplanted with Robusta Coffee.
16	..	1,888	44	50	232	512	2,726	8.7	31-66	37.90	4.3	No special treatment. Very good natural conditions.
17	A ..	2,603	290	168	489	533	4,083	13.3	31-36	27.17	2.0	Part trenched without manure 1931.
	B ..	2,086	149	137	34	440	2,846	9.3	31-36	19.85	2.1	do. do.
18	A ..	2,722	251	161	148	90	3,372	8.5	11-36	32.18	3.7	"Distance Spacing" Experiments.—1 plot treated with Superphosphate.
	B ..	2,673	107	89	8	1,050	3,927	13.0	31-36	19.30	1.4	No special treatment.
19	..	1,301	101	66	10	70	1,548	5.1	26-36	14.47	2.8	3,600 trees or roughly 12 acres of this field was cleared in September, 1932 for New Cacao Variety trials.

Counting and Crop Returns.—*Contd.*

Field No.	Bearing Trees.	Half Trees.	Quarter Trees.	Supplies.	Dead or Missing.	Total Pickets.	Acreage.	Appr. Age.	No. of bags of 165 lb.	No. of bags per acre.	Remarks
20 A ..	2,089	106	140	24	92	2,451	7.9	26-36	31.28	3.9	"Light Shade": Trenched with manure, 1926.
B ..	1,361	26	38	63	69	1,557	5.1	26-36	21.81	4.2	"No Shade": Trenchedwith manure, 1924.
C ..	918	13	33	17	78	1,059	3.4	26-36	10.26	3.0	"No Shade": Fertilizer Experiment.
D ..	1,084	11	29	6	124	1,254	4.0	26-36	11.44	2.8	"No Shade": Trenched with manure, 1932.
21 A ..	1,839	96	58	221	—	2,214	7.6	26-36	27.35	3.6	"Partial Shade": Trenched with manure, 1931-32.
B ..	1,787	156	71	582	—	2,596	8.7	26-36	25.38	2.9	do. do.
22 A ..	1,576	29	166	161	197	2,129	6.6	26-36	15.55	2.3	No Special treatment.
B ..	2,442	142	288	113	279	3,264	10.2	26-36	30.21	2.9	Trenched with manure, 1925.
C ..	787	17	77	46	218	1,145	3.5	26-36	11.08	3.1	do. do.
D ..	2,004	107	55	49	134	2,349	7.7	26-36	10.94	1.4	No special treatment.
E ..	1,050	10	30	3	123	1,216	3.8	26-36	2.67	.7	No special treatment.
23 A ..	2,399	44	61	46	208	2,758	10.1	26-36	29.85	2.9	Trenched without manure, 1924.
B ..	804	38	56	228	90	1,216	4.4	26-36	8.22	1.8	No special treatment.
C ..	1,330	39	61	320	438	2,188	8.1	26-36	16.26	2.0	Part trenched without manure 1929.
24 ..	2,163	137	111	10	430	2,851	9.2	26-36	17.34	1.8	Part trenched without manure 1929.
25 A ..	963	10	2	66	123	1,164	3.9	11-31	16.09	4.1	New Mulch Experiment. No treatment yet.
B ..	2,270	106	67	179	169	2,791	9.3	11-31	27.89	3.0	Propagation, Colour and Progeny plots.

GRAND TOTAL.

Classification of Cacao Trees and number of Acres.

	94,608	5,636	5,264	6,602	13,936	126,046	439.9	—	1164.81	2.64

REPORT OF MYCOLOGIST, 1933.

General.

The year 1933 will be remembered for the vagaries of the weather, the chief features being (*a*) a hurricane in June which effected great damage to coconut and cacao cultivations in the South of the Island ; (*b*) the excessive rainfall, especially during the latter half of the year, as a result of which the short dry period known as the Indian Summer was non-existent ; (*c*) the abnormally wet November and December, accompanied by floods, causing great crop losses in many of the cacao properties.

2. Moreover, the year under review has seen a continuance of low prices for the stable crops. This trade depression, plus diseases and pests, especially in cacao plantations, has influenced many cacao planters to embark on diversification of crops. The interplanting of coffee in the cacao fields has been practised on an extensive scale. This system is far from ideal, the shade being generally excessive. The coffee crop in such circumstances can only be expected to be poor.

3. Some cacao proprietors in the vicinity of sugar factories are substituting sugar cane for cacao. An impetus has been given to the cultivation of grapefruit and oranges ; and there is an extension in the area planted in limes. Tonka Beans (*Dipteryx* sp.), owing to the prevailing high prices, have stimulated planters to establish and extend this crop.

4. The Gros Michel variety of bananas, mainly as an interplanted crop, is receiving more and more attention as the result of a shipping Company supplying facilities.

Cacao.

Witchbroom Disease (*Marasmius perniciosus*).

5. In general, this disease has continued to spread and extend its range. A few additional centres of infection have been located in the Northern Range ; these are very slight and sporadic. As a matter of fact, the incidence in the Northern Range is mainly confined to the western end, and most of the remainder is free of the disease. The areas of heaviest infestation are in the low lying zones in Manzanilla and Guaico-Tamana where humidity and rainfall are highest. This is a conspicuous feature of the incidence of the disease and corresponds with the position found in other countries where the affection has shown itself.

6. Owing to the prevailing depression, control work has of necessity been somewhat curtailed on estates generally. The best method of control determined so far is that of collecting and destroying diseased tissues before they produce fructifications. The disease, now having been present in the Island for fully six years, has led to a preponderance of ' dry ' diseased tissues on the properties where control work has been lax. This means that on such infested plantations (*a*) sporophore production is constantly on the increase ; (*b*) the method of having special control campaigns is losing its effectiveness. In short, on such estates as above indicated, the situation demands continuous control work to be effective. The Government Cacao Estate in the Manzanilla district, where the affection is fairly severe, indicates that by making monthly ' rounds ' in the collection and destruction of witchbroom tissues, that effective control is possible and moreover, to-date, losses of mature pods are less than one per cent.

7. There are, however, large areas in cacao where the disease is relatively mild. It is in such districts that special campaign work at stated intervals should be undertaken. As previously advocated, extra efforts are required at, and following the chief flushing periods, as in this way incidence will be kept at a minimum.

Cacao in Ecuador.

8. During the year the writer visited Ecuador for the purpose of studying the status of witchbroom and also to investigate the claim of a planter that he had types of cacao resistant to the disease. A separate report has been issued anent this visit and appended is a summarised statement.

9. In the prosperous times of the Ecuador Cacao Industry, the Republic exported about twice as much cacao as Trinidad. The cropping capacity of the trees in Ecuador was similar to that of Trinidad, viz. : about one pound per tree. But during the last 17 years two major diseases have seriously reduced the crop in Ecuador. These diseases are (1) Witchbroom, and (2) Monilia.

(1) *Witchbroom* was first recorded in 1921 and spread very rapidly and has been responsible for heavy crop losses. At the time of my visit to Ecuador in May and June last, the incidence of this disease was far worse than obtains in any part of Trinidad. The methods of cultivation, paucity of labour, and difficulties of communication, rendered, control of the trouble impracticable in Ecuador.

(2) *Monilia*.—This disease was discovered about 1916 in Ecuador. It attacks pods only, not vegetative tissues. It has been responsible for great losses, and control measures have been ineffectual. Elsewhere, this disease is unknown.

10. These two major diseases have been primarily responsible for the reduction of the crop from 50,000 tons to 15,000 tons. There can be no doubt that the best method of combating witchbroom is to find and propagate resistant strains. Some time ago it came to the notice of our Department that a planter in Ecuador announced that he had a number of cacao trees which showed resistance to witchbroom.

11. At the time of my visit I found that at intervals during the last 40 years, Ecuador planters had imported cacao pods from Trinidad and Venezuela for propagation. It is some of these imported strains which show various degrees of resistance to witchbroom. Apparently, the most resistant strains approximate to the Calabacillo type of cacao. But latterly other strains of better quality have been found and propagated. All developmental work so far has been with seedlings. Whilst in Ecuador I (*a*) selected material and it is the hope of our Department to secure some of these resistant strains for propagation purposes in Trinidad ; (*b*) secured a permit from the Ecuador Government to make such introductions, but since my return to Trinidad this permit has been cancelled and efforts are being made for its re-issue.

Strains of Cacao Resistant to Witchbroom.

12. The determination that some strains of cacao are resistant to witchbroom disease gives a new lead to the methods of combating the trouble. As a matter of fact there are two methods of coping with witchbroom (*a*) the existing system of removal and destruction of diseased tissues. This method is the one at present in operation but it has been greatly hampered by the very low prices of cacao making it exceedingly difficult for the planters to undertake the work. But with improved prices much more control work would no doubt be achieved and this would not necessitated any new planting ; (*b*) the propagation of resistant strains. This involves the finding and propagation of such strains and this in turn would necessitate the replacement of existing cacao properties by the projected new ones, or the planting of areas not at present in cacao. There is no escape from the fact that this method is long-dated and cannot in itself materially benefit present day cacao planters in the near future.

13. It is quite likely, however, that resistant strains exist in Trinidad and efforts are being directed to locating them. For example, on the Government estate in Manzanilla some 4,000 trees constitute a series of manurial plots where each tree is checked for yield and witchbroom incidence. To-date, after four years, only one tree in these plots has no record of the disease and extension of this strain is being undertaken. Furthermore, certain seedlings and budded types from River Estate (Government) are being put under test at Marper Estate where opportunities for infection are much better than obtains in the Diego Martin district where River Estate is situated. In addition to the above, the Department has been conducting observations on 25 properties during the past three years. These observation plots, with 20 trees in each block, are located in different witchbroom areas, where infestation is classified as high, medium and low. In the areas where incidence is relatively high, a few trees, still show no record of the disease and these are being propagated. Supplementary to this, blocks of 100 cacao trees in each plot were selected on each of 24 properties in June, 1932. These blocks are located on the sites where witchbroom was first found on the several properties. Witchbroom inspectors make monthly checks of disease incidence throughout these plots. In this way it is hoped that it may be possible to locate certain trees which show marked resistance, or immunity ,to the affection. But the writer would emphasize that in no part of Trinidad is witchbroom incidence anything like as serious as is found in Ecuador ; hence the increased difficulty in this Colony of determining what strains are or are not showing definite evidence of resistance. Altogether, this aspect of the work is destined to be long-dated ; no short and quick methods can be applied.

Citrus.

14. All crops grown commercially are affected sooner or later with pests and diseases, and species of citrus are no exception.

15. *Pink Disease* (*Corticium Slamonicolour.*—During the year, the writer inspected several citrus groves and on two estates found slight outbreaks of this disease. Both estates are situated in wet districts. So far as is known, these are the first records of this affection being present on Citrus in the Colony. But the disease is known to be present in Trinidad on cacao, &c., as a minor disease. This disease usually attacks tissues at the point of forking of the limbs and forms a pink-to-brown incrustation on the bark ; and it is not uncommon to find the terminals of the affected twigs or branches wilt and die as a result. For the control of the trouble the removal and destruction of the affected limbs is recommended and it may be necessary to supplement this by spraying.

16. *Foot-Rot and Gummosis.*—These are general terms used by planters and others to describe a prevalent malady found on budded citrus. The problem of causation is complex In the early days, low budding was considered to be the primary cause ; but latterly, even where comparatively high budding is practised, the trouble is asserting itself. Moreover, in some instances where budded trees began to show this affection and steps were taken to apply the system known as inarching, still the malady persisted and the inarched stocks (sour orange) contracted the trouble. Much experimental work has been done in Europe and elsewhere to determine stock and scion compatibility and this phase of the problem calls for investigation in the tropics as it is highly important. The extensive experiments laid down at the St. Augustine Station where various stocks are being tried, should yield valuable data in respect of the important point known as compatibility. Also, the experiments initiated by the Manager of River Estate where a fairly large orchard of Citrus is established, may prove of great interest. These experiments are essentially designed to make a firm surface by coating a circular strip of soil around the trees with a mixture of sand and oil. In this way weed growth is inhibited and the liability of labourers damaging trees during cultivation operations is reduced to a minimum. It seems likely that much of the gummosis trouble in many citrus plots is initiated by insect irritation of the basal tissues of the stems and also by mechanical wounding caused by labourers' implements. It must not be forgotten, however, that specific disease organisms are known to be involved in the gummosis complex in many citrus growing countries.

Bananas.

17. The recent stimulus given to banana growing by the provision of shipping and marketing facilities opens up a wide field from the standpoint of disease. The Gros Michel variety being the one in demand, it behoves all growers and prospective growers to familiarise themselves with the methods of cultivation and especially with the major disease of the crop, viz. : Panama disease (*Fusarium cubense*). Already many of the planters have been circularized respecting this disease and it is recommended that :

(*a*) Demonstrations should be given in suitable centres so that everyone interested should have an opportunity of knowing Panama disease and the methods of controlling it.

(*b*) Leaflets should be distributed in all schools and posters displayed in prominent places in districts where the banana is likely to be grown.

18. Moreover, the cultural aspect requires considerable attention. Hitherto, the growing of bananas has been only of a haphazard nature and no particular attention has been given to selection of planting material, methods of propagation, systems of pruning, and selection of fruit for export. All these features are very important if a subsidiary industry in this crop is to be a success.

19. From the pathological standpoint, it will be best to grow the crop in scattered stools as much as possible, instead of in groups. By adopting this method it will lend itself to less incidence of disease. As far as one can judge, it is the cacao properties in high rainfall areas that should prove to be the best for the banana crop providing the soils are good. It must be clearly understood that Panama disease is generally distributed in the island, some areas having higher incidence than others. All growers are urged to co-operate with the Department and its large staff of district officers, as by so doing wrong methods of cultivation and ineffectual ways of treating disease will be eliminated.

20. *Gas Oil for killing Panama Disease Stools.*—Much experimental work has been done in recent years in Jamaica to devise improved methods of controlling Panama disease in the Gros Michel variety. Hitherto the costly system of digging out affected stools and burning them was the usual practice, plus a method of placing in quarantine for an indefinite number of years a specified number of surrounding banana plants no matter whether they were healthy or diseased.

21. Messrs. Trinidad Leaseholds have now put on the market a by-product of their refinery known as Gas Oil which is being used successfully for killing diseased banana stools. Through the kindness of this Company, our Department was supplied with a drum of the oil to make experimental tests. This test was made in a small plot of Gros Michel bananas where Panama disease was severe. In all, 21 affected plants were dosed, with the result that 20 of the stools were completely killed ; the remaining stool produced two suckers apparently because of insufficient dosage.

22. The method of using the Gas Oil treatment for diseased plants is as follows :—

Amount of Oil.—Two to four pints of Gas Oil per stool according to size of stool. This quantity is equal to six to twelve four ounce cigarette tins full.

Method.—Cut the plant and suckers a few inches above the soil level. Remove trash and weeds carefully around the tissues to give a free passage to the oil to reach the underground parts of the stool and soil. The oil is then applied to the stool and soil immediately surrounding it in such a way that very little is applied to the cut surfaces, the *majority* being allowed to penetrate the soil immediately touching the outside of the plant and suckers. In this way the oil readily penetrates to the underground buds and kills the "eyes" which would otherwise start new growth. The aerial parts of the diseased stool are cut up longitudinally and either burnt or treated by sprinkling with oil according to the material available.

Sterilization of Implements.—Implements used in the above work should be sterilized by washing them with Gas Oil before being re-used.

Miscellaneous.

23. *Elephant Grass* (*Pennisetum purpureum*).—This fodder crop is grown in many parts of the island. A severe infestation of *Helminthosporium sp.* was found on one plot of this grass belonging to a large sugar estate; also small outbreaks occurred in other parts of the Colony. Incidence is highest when temperatures are lowest, *i.e.*, in the early months of the year. So acute was the disease on the sugar estate above mentioned that there was practically nothing to cut for fodder.

24. Recommendations were made to destroy the affected plot and substitute other fodder crops which are resistant or immune to the disease. It was most fortunate that the affection did not attack the adjacent sugar canes; in such circumstances the situation would have been alarming. This plant parasite is one of the major diseases of sugar canes in some parts of the world and is responsible for causing great damage.

25. *Specimens for diagnosis.*—A considerable number of diseased plant specimens were received during the year for diagnosis and recommendations for methods of treatment. Planters and others are again reminded that:—

(*a*) Fragments of diseased plants are of little value for investigational purposes.

(*b*) Sufficient material should be sent so that the primary cause of the trouble may be determined

(*c*) Full particulars should be given as to the nature and extent of the damage done, the parts of the plant attacked, the nature of the soil, drainage, when it was first noticed and whether any similar kind of disease had been previously observed in the district.

(*d*) As many stages of the disease as possible should be sent, with notes as to the nature of each stage.

Visits.

26. Many estates, large and small, were visited during the year and advice given on the several affections of the crops. In addition to the visit to Ecuador already mentioned, a tour of Grenada was made at the end of the year for the purpose of determining disease incidence in bananas and other crops.

F. STELL,
Mycologist.

Investigations on Witchbroom Disease of Cacao.

During the past year further investigations were carried out on the question of Dormant Bud Infection. While the previous investigations were made upon material collected from heavily infected areas chiefly, those embodied in this report were made with inoculated material, thus ruling out the possibility of the buds having merely escaped natural infection. Cytological studies were carried out on serial sections of the inoculated dormant buds and budding trials were made also with inoculated dormant buds. A study of the fungus was made with regard to the diurnal variation in spore production, spore viability and possible differences in resistance to desiccation of spores produced at different times from the same sporophore.

2. *Cytological Investigations.*—In order to investigate further the possibility of dormant bud infection, 500 dormant vegetative buds were inoculated as well as 50 active vegetative buds which served as controls. At weekly intervals, 50 buds were removed, sectioned and examined for mycelium in the tissues.

None of the inoculated dormant buds revealed any signs of the disease in the tissues nor did they develop symptoms where activity had commenced. Of the controls, 39 developed witchbrooms, one developed into a healthy shoot and ten failed to develop.

3. *Budding with Inoculated Dormant Buds.*—In these trials 200 Dormant Vegetative Buds were inoculated and of this number 120 were selected and set upon healthy seedling stock in a disease-free area (St. Clair). The object was to determine further the possibility of dormant infection being carried in the undeveloped bud. At the time of budding 60 controls were also prepared, being uninoculated but otherwise treated in a similar manner to the subjects of the trials. The results are shown in the accompanying table:—

Treatment.	No. Budded.	Developed Symptoms.	Remained Healthy.	Failed to Develop.
Inoculated	120	—	43	77
Uninoculated Controls ..	60	—	14	46

It will be seen from the results that none of the buds developed into diseased organs. Though rather high percentage of failures which resulted cannot be attributed to the disease in question since it is correspondingly high among the uninoculated controls.

4. *Diurnal Variation in Spore Discharge.*—Data with respect to the Diurnal Variation in Spore Discharge were obtained during the months of March, August and December respectively. Sporulating mushrooms with stipes removed were allowed to deposit spores upon black paper over a period of 60 hours on each occasion. Spore-prints of three hours duration were made throughout the periods for ten mushrooms. The greatest spore output for each of the ten mushrooms occurred during the period 6 to 9 p.m. A gradual decline in the output was observed during the three periods following, *i.e.*, 9 to 12 p.m., 12 to 3 a.m., and 3 to 6 a.m. A sudden drop in spore production was then observed from 6.00 a.m. to 6.00 p.m. when only very few spores were deposited. The same variations were recorded during the ensuing 36 hours. The accompanying table serves to illustrate the intensity of spore output at different periods of the day. It will be noted that the variations were the same for the three months during which data were collected.

Month	9-12 a.m.	12-3 p.m.	3-6 p.m.	6-9 p.m.	9-12 p.m.	12-3 a.m.	3-6 a.m.	6-9 a.m.
March	0-x	0-x	0-x	4x	3x-4x	3x	2x-3x	x
August	0-x	0-x	0-x	4x	3x-4x	3x	2x-3x	x
December	0-x	0-x	0-x	4x	3x-4x	3x	2x-3x	x

0=no spores, x=very few, 2x=few, 3x=many, 4x=very many.

5. *Spore Viability.*—Heavy and light deposits of spores were made upon glass slides and exposed under ordinary atmospheric conditions. At hourly intervals some of the spores were removed and incorporated into hanging drop cultures for germination. Four replicates of heavily and lightly sown spores respectively were made in March, August and December.

In the case of the March series, heavily sown spores germinated after seven hours exposure but failed to germinate after exposures of eight hours or more. In the August series, evidence of germination in the heavily sown spores was obtained after 12 hours exposure but not after 13 hours, while in the December series germination was obtained for exposures up to ten hours.

The lightly sown spores of the three series exhibited the same viability in each case. These germinated after two hours exposure but failed to germinate after having been exposed for longer periods.

6. *Resistance of Spores to Desiccation.*—An attempt was made to determine the resistance to desiccation of spores produced early and late from the same sporophore. Thickly sown spores were exposed in ordinary atmosphere and in a desiccator respectively. One series of spores was obtained early in the spore-producing period of the mushrooms, while another series was obtained 24 hours later from the same mushrooms. Germinability of the spores was used as an index of resistance to desiccation.

Spores exposed in ordinary atmosphere germinated after exposures of 12½ hours but failed to do so after being exposed for 13 hours. Those exposed in the desiccator germinated after 120 minutes but failed to do so after being exposed for 135 minutes. No significant difference in resistance was observed between the early-and late produced spores of the same sporophore.

7. *Summary and Conclusions.*—Cytological Investigations and Budding Trials were conducted with inoculated dormant buds to supplement previous investigations which had been made with buds collected from heavily infected areas. The results of these investigations afford confirmatory evidence that dormant buds are not susceptible to infection by spores of the causative fungus, and hence that the disease is not carried in the undeveloped bud.

The discharge of spores from the sporophores is greatest between 6.00 p.m. and midnight. It continues to be appreciable until 6.00 a.m. and is almost nil between 6.00 a.m. and 6.00 p.m. The same diurnal variation is shown irrespective of seasonal differences.

Spores remain viable for a much longer period when closely grouped together on a dry surface than when they are scattered. Moisture appears to be the controlling factor, since even thickly sown spores fail to resist desiccation for more than two hours. No difference in resistance to desiccation is shown between early-and late produced spores from the same sporophore.

B. G. MONTSERIN,
Agricultural Officer.

"WILT DISEASE" OF COCONUTS.

During the year 1933 coconut wilt investigations were carried out under the following headings:—

A.—Analyses of soils and moisture determinations.
B.—Studies of the root systems of healthy and affected palms.
C.—Analyses of the ash of leaves.

A.—Analyses of Soils and Moisture Determinations.

The work has entailed a study of both static and fluctuating factors and will be discussed under these headings.

(1) Static Factors.

Samples have been collected from "Wilt" and "Wilt-free" areas on estates scattered throughout the island and have been examined for:

(*a*) Texture.
(*b*) Reaction.
(*c*) Organic Matter contents.
(*d*) Nitrogen contents.
(*e*) Carbon-Nitrogen ratio.
(*f*) Available Potassium.
(*g*) Available Phosphate.

The findings to-date have been as follows :—

(*a*) *Texture.*—The disease occurs on soils varying from very sandy to heavy clays. It would appear, therefore, that texture does not play a very important part in the incidence of the disease. The compactness of the soil, however, is apparently of some importance. The soils of " Wilt " areas and subsoils in particular are in most cases of a more compact nature than corresponding soils in " Wilt-free " areas. A discussion of this factor would entail questions of permeability to air and water, as well as drainage, and is better considered later in this summary.

(*b*) *Reaction.*—Wilt occurs on soils with pH values ranging from 4.5 to 7.5. The same range occurs in a consideration of " Wilt-free " areas. Soil reaction does not seem to play an important part in the incidence of the disease.

(*c*) *Organic Matter Contents.*—In none of the profiles studied is organic matter very abundant, nor is the extent of penetration except in one good soil, very deep. The content of the good soils is, however, uniformly higher than that of the bad soils. The maximum for good soils is 4.1 per cent. as compared with 1.8 per cent. for bad areas.

(*d*) and (*e*) *Nitrogen Content and C/N Ratio.*—For all profiles studied the value of the C/N ratio decreased with depth. While it cannot be said that there is any definite relation between the value of the *C/N* ratio and the incidence of the disease, it would appear that in some clay soils on which " Wilt " occurs the value of the ratio tends to be wider than for corresponding " Wilt-free " areas.

(*f*) *Available Potassium.*—There is a great variability in the potassium status of the soils studied so far. The results indicate that in general the good coconut areas are better supplied with this nutrient than correspondingly bad areas. The variation, however, is so great that no conclusion based on a significant statistical difference in status between contrasted areas is warranted.

(*g*) *Available Phosphate.*—With few exceptions the phosphate status of soils studied is in general low. The exceptions are about equally distributed between " Wilt " and " Wilt-free " areas, and as in the case of potassium no significant difference can be observed between contrasted areas.

(2) Fluctuating Factors.

Four plots were selected on an estate on which there were " Wilt " and " Wilt-free " fields in fairly close proximity. Composite samples were taken weekly and examined for :—

(*a*) Moisture Content.
(*b*) Nitrate content.

The samples were taken at the following depths :—

(i) 0-6
(ii) 6-12
(iii) 12-24

Fluctuations in water-table were also recorded at the same interval by means of drainage tubes sunk in the respective areas. Rainfall records were kept throughout the period.

The four plots were as follows :—

(i) Healthy area.
(ii) Wilt area.
(iii) Healthy block in Wilt area.
(iv) Wilt block in Wilt area.

(*a*) **Moisture Content.*—It is unfortunate that abnormal weather conditions were experienced throughout the period over which fluctuations in this factor have been studied. Precipitations have been high throughout and no real indication of the moisture status of these soils under normally dry conditions (this season from general observation appears to be a critical period) has been obtained. The soils have been well supplied with moisture throughout and an interesting observation has been the absence of the disease on any of the plots throughout this period.

(*b*) *Nitrate Content.*—As was to be expected from the abnormally wet weather experienced, the nitrate contents for all the plots have been very low. The leaching effect of rains, the decreased aeration due to excess moisture, and the deleterious effect of excess moisture on the nitrifying processes have resulted in the low nitrate status of the plots studied. The significance of these fluctuations as affecting crop growth is rather doubtful and one does not anticipate that such measurements will be of any great value in elucidating the problem.

Water Table Fluctuations.—Whilst, for reasons already mentioned, the absolute values of these readings may be higher than under normal rainfall conditions, they undoubtedly are useful in showing up differences between the contrasted plots. In the cases of plots 3 and 4, the water level was consistently higher for plot 4 throughout the period under consideration. Both soils are of the same texture and possess in general the same soil characteristics. The predominating difference is apparently to be found in water-table readings. Plot 4 represents a " Wilt " block in a " Wilt " area, while plot 3 is a healthy patch in an otherwise Wilt area. The differences as regards the other two plots of which the soils are lighter textured appear to be conflicting. It will be seen from later considerations that great value cannot be attached to this factor on lighter soils.

B.—Root Studies.

As a result of the poor tilth observed in most bad areas, together with the differences in water-table levels recorded in these studies, a quantitative measurement of the root systems of trees in contrasted good and bad areas was attempted.

(1) Healthy Area.

In trees in healthy areas good root development was observed to depths of five to six feet. There was a high percentage of healthy orange coloured main roots and very few dead roots were observed. Lateral root development was good.

(2) " Wilt " Area.

(*a*) *Open Texture Soil.*—Root development was observed to six feet. There was a high percentage of dark coloured main roots and many dead roots were observed. Lateral root development was good in the first two feet, but was poor in the lower depths.

(*b*) *Close-Textured with impervious Subsoil.*—These studies were made at the end of the rainy season. Root development was observed to a depth of two to three feet depending on the depth of the impervious layer. Beyond this depth a large mass of rotted roots was observed. It would appear that roots had penetrated to this depth in the previous dry period, but had been killed off by the rising water-table in the following wet period.

More detailed root studies are being carried on.

* Moisture determinations have been continued during the dry period of this year.

C.—Analyses of the Ash of Leaves.

Leaf samples from contrasted areas were examined for (*a*) total ash, (*b*) nitrogen, (*c*) potassium, and (*d*) phosphate. The number of samples analysed so far do not permit the drawing of any conclusion of statistical significance but it would appear so far, that samples from "Wilt" areas have a wider nitrogen-potassium ratio than samples from healthy areas. This line of work is being continued at present.

Discussion.

Soil reaction apparently plays very little part in the incidence of the disease and need not be discussed further.

The organic matter of good soils is higher than that of bad soils. The effect of this on the good soils as contrasted with bad soils is the better aeration and moisture holding capacity resulting from the presence of this constituent in a larger proportion. The compactness of bad coconut soils seems to be general and may be considered to be a distinguishing feature of some of these soils. This results in inadequate soil aeration and hinders proper root growth. In some cases there is pan formation leading to a temporary water-table in wet weather. In such cases not only is root growth restricted but roots which have penetrated to this depth in drier weather are killed in the ensuing wet period. It is conceivable that plants in such areas, having produced fine vegetative growth during the favourable growing period and having the root systems destroyed during the wet period, meet the dry season with root systems inadequate to supply the requirements of their vegetative structures.

Root development studies indicate that this factor is an important one in "Wilt" disease considerations. Poor lateral root development in all cases and the apparent destruction of roots in areas with impervious subsoils are points to be particularly stressed. The effect of these shortcomings on the water supply and nutrient balance of plants growing in those areas are obvious.

The availability and intake of soil nutrients by plants are so closely connected with water supply that these factors may be better considered together. While the disease undoubtedly manifests itself to a far greater extent during periods of dry weather, one must remember that the coconut palm can and does withstand drought in some areas in quite a satisfactory manner and one is forced to the interpretation that only under certain conditions does drought have this effect. It is possible that an inadequate root distribution may be a factor associated with drought leading to the onset of the disease.

In considering soil nutrients it must be kept in mind that water conditions, aeration and root development are such in "Wilt" areas at certain periods of the year as to hinder root absorption. In this light it is doubtful whether the nutrient status of the soils, as shown by the usual soil methods, serve any useful purpose in arriving at a conclusion as to the nutrient balance in the plant.

Ash analyses undoubtedly do give a better picture of the nutrient balance in the plant than do the soil data. In this connection the apparent importance of the nitrogen-potassium ratio in the leaf need be stressed.

*Experimental.

Experiments are being carried out on individual wilting plants to see if recovery can be accomplished. The following treatments have been tried with the results mentioned.

(*a*) Watering (4 trees)—3 dead, 1 dying.
(*b*) Watering+Potassium Sulphate (3 trees)—All trees died, although progress of disease was delayed.
(*c*) Watering+Superphosphate (2 trees)—Both dead.
(*d*) Watering+Ammonium Sulphate (3 trees)—All died very quickly.
(*e*) Watering+Sodium nitrate (1 tree)—dying.
(*f*) Watering+Potassium Sulphate and Ammonium Sulphate (1 tree)—to-date tree is showing definite signs of recovery.

Only trees from which young nuts were being shed and with at least six bronze leaves were selected in the experiment.

Treatment (*f*) has, so far, given the most promising results.

Large scale experiments will be laid down just previous to the rains of 1934 to try out trenching (to encourage root growth) alone, and in conjunction with fertiliser mixtures.

F. M. BAIN,
Agricultural Officer, St. George and Caroni.

REPORT FOR THE YEAR ENDING DECEMBER, 1933.

5th March, 1934.

Sir,

I have the honour to submit my report for the year ending December, 1933.

The Plant Protection staff comprised 31 assistant inspectors as in the latter half of the previous year Due to my being engaged on Coconut Soils Investigational Work, the entire staff was under the direction of Mr. Foster, Supervising Officer, Witchbroom Control. Immediately following the hurricane, 14 assistant inspectors were stationed in the southern area for the purpose of performing Agricultural Hurricane Relief work. During the latter part of the year the services of the inspectors were also utilised for collecting data in connection with the proposed banana industry. The staff was distributed as follows :—

Mosaic disease.—Three assistant inspectors, one in the northern belt and two in the Couva area.

General Inspectors.—Twenty-eight inspectors under the direction of the Supervising Officer, Mr. Foster, and his assistant, Mr. de Boehmler.

The agricultural advisers have been responsible for carrying out Plant Protection work in their respective counties.

---

* Carried out in dry season of 1934.

Control Work on Pests and Diseases.

Witchbroom.—There was a further spread of this disease during the year, 4,445 properties being known to be affected at the end of December. This was an increase of 558 properties on the corresponding number for December, 1932.

The usual seasonal variation in the numbers of brooms observed was exhibited during the year. There was a gradual increase of brooms at the beginning of the year the peak reaching its maximum in March. There was then a gradual decline until June and then a further increase until September. For the remainder of the year there was a gradual falling off in the number of brooms observed. The worst affected areas are Manzanilla, Guaico-Tamana and Mundo Nuevo. New outbreaks have occurred at Maracas Valley, heights of Guanapo and Chaguaramas.

Lectures were held as usual, the attendance being usually satisfactory. Pamphlets and posters were also distributed. Witchbroom lantern slides were shown at the theatres during the month of April.

Cacao Beetle.—Beetles were comparatively prevalent in the southern districts of the island. As a result of the destruction of shade trees and windbelts by the hurricane, an increase in the severity of beetle attacks in this area may be expected during the ensuing year. In other sections of the island, bettle attacks have not been very serious, though sporadic outbreaks have occurred in some sections.

Mosaic Disease.—This disease occurs in two main areas in Trinidad :—

(*a*) *Northern Area.*—This area is made up of plots bordering the Eastern Main Road from the 4th to the 11th mile. A few plots only are seriously affected, the incidence of the disease being generally slight. One assistant inspector under the supervision of the Adviser for St. George has carried out regular inspections and supervised the removal of infected stools.

(*b*) *Couva Area.*—This area comprises about 1,800 acres around Couva. During the year two assistant inspectors under the supervision of the Adviser for Caroni have carried out regular inspections. The incidence of the disease is higher in this area than in the Northern area. Some plots have been seriously affected, but there has been a decrease of 60 per cent. of diseased stools within the last four years.

Black Bees.—This pest has continued to do serious damage to citrus cultivations. During the year many nests were reported and destroyed.

Thrips.—This pest was reported to be doing considerable damage to cultivations in the Eastern and Central districts of the island.

Parasol Ants.—Complaints were dealt with in Port-of-Spain as usual during the year. A good many of these were on property belonging to public bodies. The destruction of these pests on Crown Lands has been carried on by the assistant inspectors, with the help of the Ward Officers. This has resulted in greater efficiency in controlling this pest.

Customs and Post Office Inspection Work.

Mr. Farrell, who has been seconded for work at the Customs Department, has carried out the usual inspection of plant material coming into the colony at the Customs and Postal Departments. This officer has also issued Inspection Certificates for plant material leaving the colony.

I have the honour to be,

Sir,

Your obedient Servant,

F. M. BAIN,
Chief Inspector, Plant Protection Ordinance.

The Honourable
THE DIRECTOR OF AGRICULTURE.

PART III.

ANNEXURES.

	Page
Revenue and Expenditure, 1933	53
Agricultural Exports, Trinidad and Tobago	54
Annual Rainfall, Port-of-Spain, Trinidad	55

APPENDIX A.

Revenue and Expenditure.

	Expenditure. £ s. d.	*Revenue.* £ s. d.
HEAD OFFICE :		
Personal Emoluments	7,848 13 1½	10 0 0
Travelling and Other Charges	1,821 15 10	10 0 0
Laboratory Expenses and Field Experiments	473 1 3	—
Banana Shipment	359 8 6	374 15 9
BOTANICAL DEPARTMENT, TRINIDAD :		
Personal Emoluments	355 19 4	—
Maintenance and Improvements, Royal Botanic Gardens and St. Clair Experiment Stations	1,315 11 7	—
Care of Trees on Government Lands	99 12 4½	—
Maintenance, Red House Grounds	74 15 7½	—
Other Charges	37 15 1½	—
BOTANICAL DEPARTMENT, TOBAGO :		
Personal Emoluments, Travelling	595 15 10	—
Maintenance, Botanic Station and Government House Grounds	318 2 5½	74 3 4½
ST. AUGUSTINE NURSERY :		
Personal Emoluments	685 6 11	—
Maintenance, &c.	2,149 1 9½	1,374 17 0½
Other Charges	379 6 2½	—
RIVER ESTATE :		
Personal Emoluments	1,021 13 10½	—
General Maintenance, &c.	3,498 19 11	2,544 13 2
Improvements	674 17 0½	—
ST. AUGUSTINE EXPERIMENT STATION :		
Personal Emoluments	570 12 8	—
Maintenance, Cultivation of Crops, &c.	1,674 15 7	379 4 8
GOVERNMENT FARM, TRINIDAD :		
Personal Emoluments	710 0 0	—
Maintenance	4,630 18 7	6,994 18 8½
Purchase of Stock (Trinidad and Tobago)	624 16 7	—
GOVERNMENT FARM, TOBAGO :		
Personal Emoluments	—	—
Maintenance	642 7 4	272 10 5
GOVERNMENT VETERINARY SURGEON :		
Assistant Examiners and Contingencies	341 2 6½	1,498 7 6
Anti-rabies Vaccine	496 19 11½	—
QUEEN'S PARK AND PASTURES :		
Personal Emoluments	125 0 0	—
Maintenance	684 3 9	283 2 8½
DISTRICT SERVICE :		
Personal Emoluments, Travelling, &c.	4,223 3 4	—
PLANT PROTECTION ORDINANCE :		
Personal Emoluments	400 0 0	—
Travelling, &c.	265 4 2	—
Destruction of Pests on Crown Lands	57 3 7½	—
Sugar-Cane Investigation	4,505 15 4½	2,379 15 4½
Control of Plant Diseases and Pests	5,225 5 7½	—
AGRICULTURAL CREDIT SOCIETIES :		
Personal Emoluments, Travelling, &c.	81 12 11½	—
TOBAGO ABATTOIR :		
Maintenance, Travelling, &c.	121 9 5	47 18 9
MARPER FARM :		
Maintenance	892 11 0½	346 4 9
Total	£47,982 19 4	£16,590 12 2½

APPENDIX B.

Principal Agricultural Exports, Trinidad and Tobago.

	1932.		1933.	
	Quantity.	Value.	Quantity.	Value.
CACAO :		£		£
Raw Cacao	41,822,127 lb	579,170	51311,274 lb	555,907
SUGAR CANE AND PRODUCTS :				
Vacuum pan, Grey Crystal	68,245 tons	611,662	92,035 tons	897,966
Do. White Crystal	..	..	..	..
Do. Yellow Crystal	16,519 tons	219,114	16,102 tons	214,193
Molasses Crystal	1,193 tons	15,098	379 tons	3,408
Muscovado Sugar	..	..	..	..
Molasses	2,701,921 gals.	14,697	3,026,077 gals.	31,634
Rum	139,540 gals.	27,521	63,907 gals.	12,853
Bitters	10,564 gals.	18,962	11,850 gals.	21,115
COCONUT AND PRODUCTS :				
Coconuts	3,847,245 No.	12,822	7,888,980 No.	21,406
Copra	15,418,906 lb.	91,444	19,357,980 lb.	82,945
Coconut Oil	26,461 gals.	2,520	45,565 gals.	3,658
COFFEE :				
Raw Coffee	908,492 lb.	20,822	339,196 lb.	7,416
RUBBER :				
Raw Rubber	..	..	..	..
LIMES :				
Limes	189 brls.	145	2,101½ brls.	2,381
Pickled Limes	..	..	13 brls.	40
Lime Juice	49,629 gals.	4,250	29,084 gals.	1,825
Lime Oil	929½ gals.	12,840	1,889 gals.	22,575
Citrate of Lime	54,217 lb.	424	52,800 lb.	389
GRAIN, PULSE, STARCHES, &C. :				
Corn (Maize)	81,376 lb.	339	..	..
Peas and Beans	300,065 lb.	1,993	393,554 lb.	2,515
FRUIT :				
Grapefruit	10,973 boxes	8,698	3,433 boxes	2,586
Oranges	1,579 boxes	1,216	650 boxes	485
Other Kinds	..	..	..	166
MISCELLANEOUS :				
Plants and Seeds	..	239	..	165
Spices (Nutmegs)	22,328 lb.	270	8,808 lb.	160
Honey	21,166 lb.	209	17,725 lb.	210
Live Stock	52 No.	2,630	79 No.	1,392
Hides and Skins	761 No.	289	9,370 No.	5,708
Leather (unmanufactured)	9,190 lb.	494	8,521 lb.	384
		£1,647,935		£1,893,482

APPENDIX C.

ANNUAL RAINFALL 1862 TO 1933, PORT-OF-SPAIN, TRINIDAD.

1862 to 1899 at the Royal Botanic Gardens. January, 1900 onwards at the closely adjacent St. Clair Experiment Station.

Year.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Rainfall.
	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Inches.
1862 ..	..	.66	.77	.25	1.41	8.47	10.36	9.57	11.97	6.60	10.06	3.03	63.15
1863 ..	1.54	2.71	1.45	.85	1.26	9.12	10.12	10.53	12.11	6.24	4.30	6.57	66.80
1864 ..	2.51	.53	.36	.04	8.15	4.96	7.17	12.06	8.04	6.53	5.94	6.61	62.90
1865 ..	2.62	3.20	1.07	7.98	3.22	5.64	10.35	14.83	7.32	14.62	4.81	9.62	85.28
1866 ..	2.24	3.91	1.44	1.09	1.45	6.59	7.83	12.34	5.87	10.11	8.17	6.82	67.86
1867 ..	1.31	6.36	.83	1.32	2.33	5.30	12.20	15.21	10.45	7.87	.67	2.71	66.56
1868 ..	2.06	.82	3.20	.64	4.17	7.78	11.35	6.73	5.46	4.66	8.31	1.03	56.21
1869 ..	.08	.93	.74	.41	.69	5.52	10.17	8.74	8.86	5.15	6.30	5.87	53.46
1870 ..	2.61	.56	1.46	1.51	4.65	8.81	11.91	9.00	10.63	3.98	5.94	8.29	69.35
1871 ..	6.62	1.40	2.89	.92	3.97	8.84	11.73	12.97	7.87	4.37	10.73	3.27	75.58
1872 ..	1.45	.07	.74	.39	3.14	7.09	5.45	10.82	3.07	4.80	9.89	3.04	49.95
1873 ..	1.78	1.08	1.98	.53	..	4.31	5.04	8.37	5.80	10.34	3.48	1.31	44.02
1874 ..	3.47	1.96	3.67	5.16	2.51	12.28	12.28	11.20	9.38	6.42	3.66	4.29	76.28
1875 ..	3.39	.91	.56	.42	2.61	4.15	12.62	7.22	11.95	10.85	3.74	2.48	60.90
1876 ..	3.26	1.03	1.78	1.67	6.65	11.17	12.23	15.18	12.03	7.04	5.95	3.96	81.95
1877 ..	2.14	..	7.46	3.38	3.19	8.43	8.35	12.94	6.39	6.68	7.66	5.48	72.10
1878 ..	3.44	.70	..	3.22	4.99	5.78	5.42	8.88	11.15	5.89	8.72	3.05	61.24
1879 ..	1.52	2.76	4.56	3.03	3.08	14.92	6.86	10.35	6.15	3.54	4.28	4.38	65.43
1880 ..	11.72	6.53	.67	2.32	3.90	7.83	6.30	17.39	7.47	5.74	10.51	1.96	82.34
1881 ..	.57	.65	.23	1.60	4.66	11.05	7.82	10.90	10.59	3.36	12.06	2.23	65.72
1882 ..	1.33	2.38	.73	1.57	3.74	6.33	5.93	8.40	4.93	5.86	10.29	1.50	52.99
1883 ..	1.56	.71	.26	3.37	5.89	10.91	13.66	10.26	5.53	3.99	6.06	8.30	70.50
1884 ..	3.43	2.50	4.40	1.51	2.91	6.84	5.71	8.70	5.03	5.05	5.14	5.66	56.88
1885 ..	1.30	.89	1.49	.43	5.27	3.44	5.87	4.56	6.08	4.08	5.37	4.44	43.22
1886 ..	3.32	1.97	3.27	3.83	4.49	9.70	17.48	8.15	6.73	12.59	8.54	6.75	86.82
1887 ..	2.69	1.46	1.67	1.08	3.98	7.40	5.51	9.93	5.07	5.84	7.60	11.86	64.09
1888 ..	8.37	1.79	2.41	2.28	3.46	11.92	6.89	7.02	5.53	5.06	7.76	2.95	65.44
1889 ..	.94	.85	4.16	1.05	6.34	11.66	12.14	11.73	3.76	6.30	7.38	7.48	73.79
1890 ..	7.76	.51	2.09	7.62	5.14	9.68	12.89	11.65	3.37	10.98	5.93	5.28	82.90
1891 ..	3.17	.92	.03	1.44	2.54	5.54	11.88	4.26	7.44	5.77	6.66	4.09	53.74
1892 ..	1.93	2.19	1.85	7.59	11.55	16.26	15.55	9.21	3.57	11.49	5.40	4.69	91.28
1893 ..	3.43	1.85	.19	3.61	11.35	10.19	13.28	16.32	11.73	5.47	7.84	7.23	92.49
1894 ..	3.22	2.36	3.12	1.22	2.69	3.26	4.53	12.06	5.48	3.93	7.28	3.16	52.31
1895 ..	2.52	1.33	2.27	2.52	2.11	5.00	2.57	4.86	5.69	10.89	15.15	7.32	62.23
1896 ..	7.08	.88	1.59	2.33	1.62	10.29	6.35	7.66	6.46	6.05	9.81	6.33	66.45
1897 ..	1.67	.75	3.96	.26	5.58	11.19	13.88	7.90	9.83	8.87	9.39	4.40	77.68
1898 ..	3.05	2.18	2.10	1.17	1.49	6.46	5.87	10.55	7.13	6.15	9.13	3.57	58.85
1899 ..	1.95	1.82	1.00	.75	.52	7.63	4.44	8.45	2.18	6.34	8.07	3.61	46.76
1900 ..	3.56	.76	2.72	4.10	4.14	12.99	7.95	11.07	5.52	6.53	5.41	2.61	67.36
1901 ..	1.95	1.51	1.85	.35	6.45	9.21	8.38	7.53	4.26	4.97	7.93	4.83	59.22
1902 ..	2.56	.51	1.18	1.78	2.14	10.05	5.20	11.67	7.22	7.40	2.74	2.89	55.34
1903 ..	1.51	.68	1.54	2.17	.95	5.42	9.40	9.45	11.41	2.12	2.59	4.20	51.44
1904 ..	3.00	2.56	4.24	2.50	2.76	6.23	8.03	4.72	8.81	5.65	3.61	4.32	56.43
1905 ..	2.41	.59	3.74	1.79	4.34	6.01	9.49	11.09	10.43	6.94	10.69	4.16	71.68
1906 ..	.43	.50	.73	.46	7.96	10.95	11.42	8.55	6.54	6.80	5.00	5.64	64.98
1907 ..	5.22	.44	1.71	.09	4.58	11.01	11.02	5.77	7.76	7.65	10.69	4.10	70.04
1908 ..	.75	.45	1.79	.95	5.82	5.22	5.87	7.72	5.45	5.45	2.65	8.68	50.80
1909 ..	5.69	2.43	1.15	1.78	3.87	8.31	10.72	6.29	6.95	7.15	3.93	6.31	64.58
1910 ..	2.79	4.38	1.75	2.01	2.76	6.34	6.40	13.89	8.27	9.21	8.49	1.90	68.19
1911 ..	1.61	1.51	1.86	.74	1.27	7.15	5.20	13.68	4.03	10.22	3.57	3.53	54.37
1912 ..	.62	Nil.	.74	.03	2.18	7.54	12.16	5.56	5.87	2.73	6.28	5.64	49.35
1913 ..	2.80	.50	1.42	.42	1.79	2.80	2.86	6.48	6.52	3.51	8.61	1.82	39.53
1914 ..	.50	.61	1.28	1.01	2.05	7.34	5.05	9.15	7.80	6.14	7.61	5.58	54.12
1915 ..	2.10	.66	..	2.63	2.76	7.05	12.76	5.27	4.21	9.28	7.84	1.75	56.31
1916 ..	5.29	1.35	1.57	1.91	.94	10.30	8.04	11.57	10.78	6.68	9.32	1.98	69.73
1917 ..	1.17	3.06	1.38	.50	4.24	6.30	10.13	9.96	7.24	5.43	6.61	8.22	64.24
1918 ..	3.15	1.18	1.48	1.27	2.94	5.87	14.42	8.56	8.93	5.51	7.56	3.85	64.72
1919 ..	.62	..	1.78	1.67	3.50	6.78	5.17	6.82	7.96	7.79	8.42	6.67	57.18
1920 ..	1.39	1.66	.94	.28	.56	4.13	4.93	6.70	10.98	5.74	6.03	1.60	44.94
1921 ..	2.43	1.60	5.03	4.09	1.43	9.91	10.06	10.30	10.17	6.53	7.71	6.25	75.51
1922 ..	4.01	1.13	1.41	2.39	2.18	6.10	5.06	8.35	6.49	2.92	11.17	7.10	58.31
1923 ..	1.91	1.66	.96	2.97	1.46	3.48	10.76	9.37	6.23	4.41	7.38	7.32	57.91
1924 ..	1.54	.90	.14	1.11	.73	4.95	7.53	7.27	4.59	7.81	8.56	2.15	47.28
1925 ..	1.77	1.06	2.67	.10	1.21	4.20	7.58	8.87	6.37	5.85	5.36	4.36	49.40
1926 ..	.69	.39	.54	.23	2.12	5.26	5.25	10.85	11.20	14.78	9.71	7.56	68.58
1927 ..	4.71	4.44	3.62	5.04	7.15	6.95	9.40	11.67	9.11	6.13	5.64	7.21	81.07
1928 ..	4.22	.69	2.31	2.02	.67	5.75	8.07	8.66	7.36	9.13	8.42	5.94	63.24
1929 ..	.84	.84	1.78	.81	7.33	6.43	5.10	8.90	5.21	3.40	9.30	1.51	51.45
1930 ..	2.70	.08	.31	2.38	1.85	6.35	7.12	4.94	5.82	6.27	2.59	4.87	45.28
1931 ..	1.68	1.11	.07	.29	1.12	6.94	10.96	8.89	4.85	6.59	7.94	5.77	56.21
1932 ..	5.61	1·72	4.33	3.99	9.25	10.53	5.80	16.04	3.85	4.60	10.23	8.01	83.96
1933 ..	3.87	1.25	1.91	1.36	2.85	10.19	9.93	16.07	11.52	7.41	5.38	6.29	78.03
Grand Total ..	198.15	106.32	132.38	135.58	254.05	555.88	627.21	698.58	525.78	478.23	512.95	349.24	4,574.35
Av. for 72 years	2.75	1.48	1.84	1.89	3.53	7.72	8.71	9.70	7.30	6.64	7.12	4.85	63.53